Boletes from Belize and the Dominican Republic

Beatriz Ortiz-Santana[1*], D. Jean Lodge[2], Timothy J. Baroni[3] and Ernst E. Both[4]

[1]Center for Forest Mycology Research, Northern Research Station, USDA-FS, Forest Products Laboratory, One Gifford Pinchot Drive, Madison, Wisconsin 53726-2398, USA
[2]Center for Forest Mycology Research, Northern Research Station, USDA-FS, PO Box 1377, Luquillo, Puerto Rico 00773-1377, USA
[3]Department of Biological Sciences, PO Box 2000, SUNY-College at Cortland, Cortland, New York 13045, USA
[4]Buffalo Museum of Science, 1020 Humboldt Parkway, Buffalo, New York 14211, USA

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This paper presents results of surveys of stipitate-pileate *Boletales* in Belize and the Dominican Republic. A key to the *Boletales* from Belize and the Dominican Republic is provided, followed by descriptions, drawings of the micro-structures and photographs of each identified species. Approximately 456 collections from Belize and 222 from the Dominican Republic were studied comprising 58 species of boletes, greatly augmenting the knowledge of the diversity of this group in the Caribbean Basin. A total of 52 species in 14 genera were identified from Belize, including 14 new species. Twenty-nine of the previously described species are new records for Belize and 11 are new for Central America. In the Dominican Republic, 14 species in 7 genera were found, including 4 new species, with one of these new species also occurring in Belize, i.e. *Retiboletus vinaceipes*. Only one of the previously described species found in the Dominican Republic is a new record for Hispaniola and the Caribbean.

Key words: *Boletales*, Caribbean, Central America, systematics

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*Corresponding author: Beatriz Ortiz-Santana; e-mail: bortizsantana@fs.fed.us

Introduction

A survey of *Boletales* (Binder and Hibbett, 2006) was conducted in Belize on the Yucatan Peninsula in northern Central America and the Dominican Republic on the island of Hispaniola in the Caribbean. This US National Science Foundation funded survey was an extension of a previous survey in the Greater Antilles, and part of a broader research program to elucidate the biogeographic and phylogenetic relationships among basidiomycete fungi on different Caribbean islands and between islands and the mainland. Recently, there has been an increase in morphological and molecular studies determining the biogeographic and evolutionary relationships among populations on various Caribbean islands and the mainland. Most previous research was on vertebrate animals and vascular plants (Berminghan, 1994; Davies and Bermingham, 2002; Graham, 2003; Dávalos, 2004; Santiago-Valentín and Olmstead, 2004; Hedges, 2006a,b), while a few studies were on fungi (James and Vilgalys, 2001; Mata *et al.*, 2001; Weinstein and Pfister, 2002). The animal and plant studies demonstrated high biodiversity in the region resulting from a combination of high endemism as well as the presence on Caribbean islands of disjunct populations of species known from Central, North and South America and Africa. This paper presents survey results for stipitate-pileate ectomycorrhizal *Boletales* (commonly named as boletes) in Belize and the Dominican Republic, providing useful data for future comparisons of Caribbean populations with those from Central and North America.

Inventories of fungi in the Caribbean region have increased significantly during the last decade, particularly through the "Basidiomycetes of the Greater Antilles" project (Lodge *et al.*, 2002). Through that project, a survey of macrobasidiomycete fungi (mushrooms, polypores, puffballs and jelly fungi) was performed on the islands of Hispaniola, Jamaica, Puerto Rico and the

Virgin Islands. Although a considerable number of specimens were collected, the mycologists involved in the research have been working mainly in the identification and revision of agarics, polypores and jelly fungi. Based on morphological characters, the researchers showed the existence of disjunct fungal populations that occur in the Greater Antilles as well as in the Lesser Antilles, North, Central or South America or Africa (Baroni *et al.*, 1997; Baroni and Lodge, 1998; Miller *et al.*, 2000; Ryvarden, 2000a,b,c; Cantrell and Lodge, 2001, 2004; Cantrell *et al.*, 2001; Lodge *et al.*, 2002). Previous reports of basidiomycete fungi from the Caribbean region (mainly from the Greater Antilles) along with preliminary results of the Basidiomycetes of the Greater Antilles Project were summarized by Lodge *et al.* (2002).

The previous survey results included evidence of disjunct populations of ectomycorrhizal fungi between the Dominican Republic and North America (Miller *et al.*, 2000; Cantrell *et al.*, 2001; Lodge *et al.*, 2002). Although most of the ectomycorrhizal fungi identified from the Dominican Republic also occur in eastern USA, a few are disjunct populations of species known from western North America. Some examples of ectomycorrhizal species with disjunct populations in the Dominican Republic and the eastern USA included: *Boletellus coccineus* var. *coccineus* (Fr.) Singer and *Strobilomyces confusus* Singer. Examples of taxa that have disjunct populations in the Dominican Republic and western North America included: *Lactarius deliciosus* var. *areolatus* A.H. Sm., *L. rubrilacteus* Hesler & A.H. Sm. and *L. scrobiculatus* var. *canadensis* (A.H. Sm.) Hesler & A.H. Sm. (Cantrell *et al.*, 2001; Lodge *et al.*, 2002).

Based on the results from the research noted above, we focused this study on stipitate-pileate ectomycorrhizal *Boletales* to improve our understanding of the diversity and biogeographic patterns of these fungi between North America and the Caribbean region. In terms of the diversity of *Boletales* in Central America, a few reports have been published from Belize, Guatemala, Honduras and Nicaragua (Singer *et al.*, 1983, 1990a-1992; García *et al.*, 1986; Gómez, 1986; Flores and Simonini, 2000; Kropp, 2001), but most of the studies have been concentrated in Costa Rica (Singer *et al.*, 1983, 1990a-1992; Singer and Gómez, 1984; Gómez, 1992, 1996; Halling, 1999; Halling and Mueller, 1999, 2003, 2005; Halling *et al.*, 1999); those studies showed a biogeographical connection between North and Central American *Boletales*.

In this paper we present a brief synopsis of the systematics in the *Boletales* and their distribution in the Americas. This is followed by a systematic treatment of species encountered during the survey, including keys, descriptions, drawings and color photographs of ectomycorrizal *Boletales*, primarily those associated with *Pinus caribaea* Morelet and various species of

Quercus in Belize and with *Pinus occidentalis* Swartz in the Dominican Republic. One new species of bolete from Belize was associated with *Coccoloba uvifera* (L.) L. All 58 species are described and illustrated, including 17 that are new to science.

Systematics in the Boletales

The order *Boletales* was first proposed by Gilbert (1931) to include all above ground fungi with fleshy and putrescent fruit bodies (basidiocarps) and a tubulate hymenophore (the spore producing surface). The classification of the order *Boletales* was initially based on the morphology of macrocharacters, then combining the morphology of macro- and microscopic characters with anatomical and biochemical criteria. Singer (1981) classified the *Boletales* in the Kingdom Fungi, Division Basidiomycota, Class Basidiomycetes, Order *Agaricales* and Suborder *Boletineae*, with three families, six subfamilies and 33 genera; this classification was based on their poroid or sublamellate hymenophore. Later in 1986, Singer grouped them into one family, the *Boletaceae*, and six subfamilies in the order *Agaricales*. Recent revisions have resulted from the integration of molecular characters and phylogenetic analyses with morphological data. Currently, the *Boletales* has been divided into six suborders, approximately 19 families and 70 genera, grouping taxa with different fruit body morphology including poroid, gilled, resupinate, hypogeous and epigeous gasteroid forms (Kretzer *et al.*, 1996; Hibbett *et al.*, 1997; Kretzer and Bruns, 1997; Bruns *et al.*, 1998; Binder, 1999; Hughey *et al.*, 2000; Grubisha *et al.*, 2001, 2002; Binder and Bresinsky, 2002a,b; Binder and Hibbet, 2002, 2004, 2006).

Distribution and diversity of boletes in the Americas

As most boletes are obligate ectomycorrhizal symbionts, their biogeographical distribution depends on the distribution of their host plants. The invasion of new geographical areas by a plant host and its symbiotic fungi must occur simultaneously to ensure successful establishment in the new area (Richardson and Runde, 1998). In North and parts of Central America, boletes are associated mainly with members of the *Betulaceae* (birch and alder), *Fagaceae* (oaks and beech), *Pinaceae* (fir, hemlock, larch, pine, and spruce) and *Salicaceae* (willows) (Newman and Reddell, 1987). In the Neotropics, members of the *Fabaceae* (caesalpinoid legumes), *Nyctaginaceae* (e.g., *Neea* and *Pisonia* spp.) and *Polygonaceae* (especially *Coccoloba* spp.) are the

predominant ectomycorrhizal hosts (Alexander and Hogberg, 1986; Newman and Reddell, 1987; Moyerson, 1993; Lodge, 1996; Henkel *et al.*, 2002).

In terms of distribution and diversity of boletes in the Americas, there are several studies that document their presence in North America, northern South America, and the Caribbean region. It is evident that their distribution is not completely known for some countries in Central America and the Caribbean Islands. North America (excluding Mexico) has the highest number of described boletes with approximately 300 species associated with several host plants including 60 species of oak and 35 of pine (Miller and Lamb, 1985; Morin, 1997; Richardson, 1998). Most of the studies have been performed in the eastern part from eastern Canada, New York to Florida and California (Peck, 1889; Coker and Beers, 1943; Singer, 1945-1947; Smith and Thiers, 1964, 1971; Snell and Dick, 1970; Thiers, 1975, 1976; Grund and Harrison, 1976; Phillips, 1991; Both, 1993; Bessette *et al.*, 2000). In Mexico, approximately 212 taxa of boletes have been documented, mainly from the southeastern state of Veracruz, associated with 52 host plants, primarily pines and oaks (Singer *et al.*, 1983, 1990a-1992; García *et al.* 1986; 1987; Gómez, 1996; García, 1999; García and Garza, 2001).

In Central America most of the studies have been concentrated in Costa Rica with 84 species of boletes associated with approximately 12 species of oaks (Singer *et al.*, 1983, 1990a-1992; Singer and Gómez, 1984; Gómez, 1992, 1996; Halling, 1999; Halling and Mueller, 1999, 2003, 2005; Halling *et al.*, 1999; web site: http://www.nybg.org/bsci/res/hall). In Belize 13 bolete species were noted in association with *Pinus caribaea* and *Quercus* spp. (Singer *et al.*, 1983, 1990a-1992; García *et al.*, 1986; Kropp, 2001). In Guatemala, only seven species associated with *P. caribaea* and *Quercus* spp. were mentioned (Singer *et al.*, 1983; Gómez, 1996; Flores and Simonini, 2000). In Nicaragua, only six species associated with *P. caribaea* were reported (Singer *et al.*, 1983, 1990a-1992; Gómez, 1996). Twelve species associated with *P. caribaea* were reported from Honduras (Singer *et al.*, 1983, 1992; Gómez, 1996; Flores and Simonini, 2000).

In South America, 23 species of boletes associated mainly with *Quercus humboldtii* Bonpl., were reported from Colombia (Halling, 1989, 1992; Singer *et al.*, 1990b; Halling *et al.*, 1999; Franco and Uribe, 2000). In Guyana, aproximately 24 bolete species have been identified associated with the ectomycorrizal leguminous trees *Dycimbe corymbosa, Dycimbe altsonii* and *Aldina insignis* (Henkel, 1999, 2001; Henkel *et al.*, 2002; Fulgenzi *et al.*, 2007).

In the Caribbean region, approximately 18 species of boletes associated with *Pinus* spp., *Coccoloba* spp. and *Quercus* spp. were reported from Cuba (Portales *et al.*, 1999). In the Dominican Republic, at least 12 species of boletes

have been noted in general publications (Minter *et al.*, 2001; Lodge *et al.*, 2002).

Materials and Methods

Description of the study sites

Belize is located on the Caribbean coast of northern Central America, on the southern part of the Yucatan Peninsula between Guatemala, Honduras and Mexico. The principal areas sampled included two main tropical pine habitats: low elevation mountain forest (Mountain Pine Ridge region) with an elevation range of 300-600 m asl located in the southwestern part of the country and lowland pine savanna (central eastern region) with an elevation below 100 m asl. These habitats range from pure pine forests to mixed forests (pines, oaks and hardwoods). The Mountain Pine Ridge has two pine species (*Pinus caribaea* Morelet var. *hondurensis* (Sénéclauze) Barrett & Goflariand and *P. oocarpa* Schiede & Schlechtendal) and several species of oaks (*Quercus oleoides* Schlecht. and Cham., *Q. peduncularis* (Trel.) Mull. and *Q. sapotaefolia* Liebm.). The lowland pine savanna is mainly composed of *P. caribaea* var. *hondurensis*, *Q. oleoides* and *Q. peduncularis* (Means, 1997; Richardson and Runde, 1998). Soils in the Mountain Pine Ridge included sandy soils derived from granite, highly weathered red or yellow clays, and organic muck in swampy areas, while those at low elevation were sandy (pine ridges on old sandy shorelines), or silty loams derived from uplifted marine deposits.

The Dominican Republic is located between the Caribbean Sea to the south and the Atlantic Ocean to the north; it occupies the eastern two-thirds of the island of Hispaniola, which it shares with Haiti. The areas studied were located in the Central Mountain Range (Cordillera Central) where the vegetation is dominated by the endemic pine, *Pinus occidentalis* Swartz. These areas have elevations ranging from (600-) 850-2500 m asl (Martínez, 1998). Many boletes were collected in the following parks: "Parque Nacional Valle Nuevo", "Armando Bermudez", "José del Carmen Ramírez" and the "Ebano Verde Reserve". Areas outside of National Parks and Reserves yielding boletes included the communities of Jarabacoa, Jumanuco, Los Dajaos and Manabao in La Vega Province, and Carrizal, La Celestina, Las Placetas, Los Montones Arriba (Plan Sierra Convention Center grounds), and Rincón de Piedra in Santiago Province. The soils were often highly weathered red clays, but sandy soils were encountered in areas with exposed granite diorite.

Description and deposit of specimens

Colors with capitalized names are from Ridgway as reproduced by Smithe (1975); numerical color designations in parenthesis are from Kornerup and Wanscher (1978); color terms not capitalized are general approximations. Macro-chemical reactions were determined using 5% KOH and 10% NH_4OH. Microscopic structures were observed in 5% KOH and Melzer's solution. In the description of spore dimensions, the first values correspond to the range of lengths and widths with exceptional values in parentheses, followed in parentheses by *n* - the number of spores measured, the mean spore lengths and widths ± their standard deviation, and the Q_m value, which represents the mean Q value ± the standard deviation. The mean Q was taken as the mean of all E values, where E = length/width of each spore measured. Herbarium acronyms are from Holmgren *et al.* , 1990; http://sweetgum.nybg.org/ih/.

Results and Discussion

The results of this study have greatly augmented the knowledge of the diversity and distribution of ectomycorrhizal boletes in the Caribbean Basin. Approximately 456 collections were recorded from Belize and 222 from the Dominican Republic including 58 identified species over a four-year period from 2001 to 2004. Species classification follows Singer (1986) with modifications by Binder and Hibbett (2004, 2006). A summary of the classification of the identified boletes is presented in Table 1. It is important to note that the systematics of some genera and species of *Boletales* is still under study, such as *Boletellus*, *Boletus edulis*, *Phylloporus*, *Tylopilus* and *Xerocomus*, and that the present classification may change with the incorporation of new data.

We identified 52 species in the *Boletales* in Belize and 14 in the Dominican Republic, eight of these species found in the Dominican Republic were also found in Belize (*Austroboletus subflavidus*, *Boletellus coccineus* var. *coccineus*, *Retiboletus griseus*, *R. vinaceipes*, *Tylopilus ballouii*, *Strobilomyces confusus*, *Suillus decipiens* and *S. salmonicolor*; Table 2). From 27-29% of the boletes in Belize and the Dominican Republic were previously undescribed, which was expected since we were working in areas with few previous studies. Of the 52 species from Belize, 14 are described as new (27%). In addition, twenty-nine new records of boletes were added to the 13 species that were previously described or reported from Belize (Kropp, 2001; García *et al.*, 1986; Singer *et al.*, 1983, 1990a-1992) for a total of 56 species now known from the country.

Table 1. Taxonomy of the *Boletales* from Belize and the Dominican Republic based mainly on Singer's classification of the *Boletaceae* in the *Agaricales* (Singer, 1986).

Genera and sections of the identified species
AUSTROBOLETUS (Corner) Wolfe
Section AUSTROBOLETUS Wolfe
Austroboletus subflavidus (Murrill) Wolfe
Section GRACILES Wolfe
Austroboletus gracilis (Peck) Wolfe var. *gracilis*
BOLETELLUS Murrill
Section BOLETELLUS
Boletellus coccineus (Fr.) Singer *var. coccineus*
Boletellus coccineus var. amarus Singer
Section CHRYSENTEROIDEI Singer
Boletellus belizensis B. Ortiz & T.J. Baroni sp. nov.
Boletellus cubensis (Berk. & M.A. Curtis) Singer
Boletellus domingensis B. Ortiz & Lodge sp. nov.
Section IXOCEPHALI Singer
Boletellus singerii Gonz.-Velázq. & R. Valenz.
BOLETUS Dill. ex Fr.
Section APPENDICULATI Konrad & Maubl.
Boletus aureissimus (Murrill) Murrill
Boletus auripes Peck
Section AURIPORI (Singer) Singer (in genus *Pulveroboletus*)
Boletus cf. *auriporus* Peck
Section BOLETUS Fr.
Boletus occidentalis B. Ortiz & T.J. Baroni sp. nov.
Boletus variipes var. fagicola A.H. Sm. & Thiers
Section CALOPODES Fr.
Boletus inedulis (Murrill) Murrill
Boletus pallidus Frost
Section LURIDI Fr.
Boletus brunneopanoides B. Ortiz sp. nov.
Boletus cf. *caribaeus* (Singer) Singer
Boletus dupainii Boud.
Boletus firmus Frost
Boletus floridanus (Singer) Singer
Boletus guatemalensis R. Flores & Simonini
Boletus hypocarycinus Singer
Boletus mahoganicoloroides B. Ortiz, Both & T.J. Baroni sp. nov.
Boletus pseudofrostii B. Ortiz sp. nov.
Boletus vermiculosus Peck
Section MIRABILES Singer (in genus *Boletellus*)
Boletus projectelloides B. Ortiz, Both, Halling & T.J. Baroni sp. nov.

Table 1 continued. Taxonomy of the *Boletales* from Belize and the Dominican Republic based mainly on Singer's classification of the *Boletaceae* in the *Agaricales* (Singer, 1986).

Genera and sections of the identified species
BOLETUS Dill. ex Fr.
Section SUBPRUINOSI Fr. em Singer
Boletus brunneotomentosus B. Ortiz sp. nov.
Boletus neotropicus B. Ortiz & T.J. Baroni sp. nov.
Boletus roseoareolatus B. Ortiz & T.J. Baroni sp. nov.
Boletus rugulosiceps B. Ortiz, T.J. Baroni & Lodge sp. nov.
FISTULINELLA Hennings
Section SCROBICULATI Singer
Fistulinella conica (Ravenel) Pegler & T.W.K. Young var. *conica*
GYROPORUS Quél.
Gyroporus castaneus (Fr.) Quél.
Gyroporus cf. *phaeocyanescens* Singer & M.H. Ivory
HEIMIOPORUS E. Horak
Section RETISPORI Singer (in genus *Boletellus*)
Heimioporus ivoryi (Singer) E. Horak
LECCINUM Gray
Section LECCINUM
Leccinum cf. *holopus* var. *americanum* A.H. Sm. & Thiers
Leccinum violaceotinctum B. Ortiz & T.J. Baroni sp. nov.
Section LUTEOSCABRA
Leccinum cf. rugosiceps (Peck) Singer
PHYLLOPORUS Quél.
Section MANAUSENSES Singer
Phylloporus boletinoides A.H. Sm. & Thiers
Section PHYLLOPORUS
Phylloporus rhodoxanthus (Schwein.) Bres.
Phylloporus scabripes B. Ortiz & M.A. Neves sp. nov.
PULVEROBOLETUS Murrill
Section PULVEROBOLETUS
Pulveroboletus ravenelii (Berk. & M.A. Curtis) Murrill
Section RETICULATI Singer
Pulveroboletus auriflammeus Berk. & M.A. Curtis
RETIBOLETUS Manfr. Binder & Bresinsky
Section GRISEI (Singer) Singer (in genus *Boletus*)
Retiboletus griseus (Peck) Manfr. Binder & Bresinsky
Retiboletus vinaceipes B. Ortiz, Lodge & T.J. Baroni sp. nov.
Section ORNATIPEDES Singer (in genus *Boletus*)
Retiboletus ornatipes (Peck) Manfr. Binder & Bresinsky

Table 1 continued. Taxonomy of the *Boletales* from Belize and the Dominican Republic based mainly on Singer's classification of the *Boletaceae* in the *Agaricales* (Singer, 1986).

Genera and sections of the identified species
STROBILOMYCES Berk.
Section STROBILOMYCES
Strobilomyces confusus Singer
Strobilomyces strobilaceus (Scop.: Fr.)Berk.
SUILLUS Gray
Section SOLIDIPEDES (Singer) Singer
Suillus decipiens (Berk. & M.A. Curtis) Kuntze
Section SUILLUS
Suillus brevipes (Peck) Kuntze
Suillus pseudoalbivelatus B. Ortiz & Lodge sp. nov.
Suillus salmonicolor (Frost) Halling
Suillus tomentosus (Kauffman) Singer
TYLOPILUS P. Karst.
Section OXYDABILES Singer
Tylopilus ballouii (Peck) Singer
Section ROSEOSCABRA Singer
Tylopilus chromapes (Frost) A.H. Sm. & Thiers
Section TYLOPILUS
Tylopilus violatinctus T.J. Baroni & Both
XEROCOMUS Quél.
Section PSEUDOPHYLLOPORI Singer
Xerocomus pseudoboletinus (Murrill) Singer
Section XEROCOMUS
Xerocomus belizensis B. Ortiz & T.J. Baroni sp. nov.
Xerocomus olivaceus B. Ortiz & T.J. Baroni sp. nov.

Of the total number of species found in Belize, thirty-one occur in the eastern USA and three of these also occur in the western USA (*Gyroporus castaneus*, *Pulveroboletus ravenelii*, and *Suillus brevipes*). Of the 31 species in common between the USA and Belize, 18 are reported also from Mexico in southern North America, and 17 have been previously reported from Central America. Seven of the previously described taxa we found in Belize are only known from Central America, Mexico or the Caribbean (*Boletellus coccineus* var. *amarus*, *B. cubensis*, *B. singerii*, *Boletus caribaeus*, *B. guatemalensis*, *Gyroporus phaeocyanescens* and *Heimioporus ivoryi*; Table 2).

Table 2. Identified boletes from Belize and the Dominican Republic and their distribution in the Americas (CA= Central America; BZ= Belize, G= Guatemala; H= Honduras; N= Nicaragua, CR= Costa Rica; NA= North America; M= Mexico; E= Eastern USA; SE= Southeastern USA; NE= Northeastern USA; GC= Gulf Coast; W= Western USA; CI= Caribbean Islands; B= Bahamas; C= Cuba; DR= Dominican Republic; SA= South America; CO= Colombia; * = Records from the present work).

Bolete species	Distribution			
	CA	NA	CI	SA
Austroboletus gracilis	CR	M, E	DR*	
Austroboletus subflavidus	BZ*, CR	M, E, GC	DR	
Boletellus belizensis	BZ*			
Boletellus coccineus var. coccineus	BZ*, G, CR	M, SE, GC	C, DR	CO
Boletellus coccineus var. amarus	BZ*, H, CR		B	
Boletellus cubensis	BZ*, CR	M	C	
Boletellus domingensis			DR*	
Boletellus singerii	BZ*	M		
Boletus aureissimus	BZ*	SE, GC		
Boletus auripes	BZ*	M, E		
Boletus cf. *auriporus*	BZ*, CR	M, E, G		
Boletus brunneopanoides	BZ*			
Boletus brunneotomentosus	BZ*			
Boletus cf. *caribaeus*	BZ			
Boletus dupainii	BZ*	NC		
Boletus firmus	BZ*, CR	NE, GC		
Boletus floridanus	BZ*	M, SE, GC		
Boletus guatemalensis	BZ*, G			
Boletus hypocarycinus	BZ*	M, SE, GC		
Boletus inedulis	BZ*	M, E		
Boletus mahoganicoloroides	BZ*			
Boletus neotropicus	BZ*			
Boletus occidentalis			DR*	
Boletus pallidus	BZ*	M, E		
Boletus projectelloides	BZ*			
Boletus pseudofrostii	BZ*			
Boletus roseoareolatus	BZ*			
Boletus rugulosiceps	BZ*			
Boletus variipes var. fagicola	BZ*, CR	M, MI		
Boletus vermiculosus	BZ*, CR	M, NE, E		
Fistulinella conica	BZ*	M, SE		
Gyroporus castaneus	BZ, H, CR	M, E, W		
Gyroporus cf. *phaeocyanescens*	BZ			
Heimioporus ivoryi	BZ, CR	M		
Leccinum cf. *holopus var. americanum*	BZ*	NE		
Leccinum cf. *rugosiceps*	BZ*, CR	M, E, GC		
Leccinum violaceotinctum	BZ*			

Table 2 continued. Identified boletes from Belize and the Dominican Republic and their distribution in the Americas (CA= Central America; BZ= Belize, G= Guatemala; H= Honduras; N= Nicaragua, CR= Costa Rica; NA= North America; M= Mexico; E= Eastern USA; SE= Southeastern USA; NE= Northeastern USA; GC= Gulf Coast; W= Western USA; CI= Caribbean Islands; B= Bahamas; C= Cuba; DR= Dominican Republic; SA= South America; CO= Colombia; * = Records from the present work).

Bolete species	Distribution			
	CA	NA	CI	SA
Phylloporus boletinoides	BZ*	E, GC		
Phylloporus rhodoxanthus	BZ*	E		
Phylloporus scabripes	BZ*			
Pulveroboletus auriflammeus	BZ*	M, E		
Pulveroboletus ravenelii	BZ, N, CR	M, E, G, W		CO
Retiboletus griseus	BZ*, G	M, NE, SW	DR	
Retiboletus ornatipes	BZ*, CR	E		
Retiboletus vinaceipes	BZ*		DR*	
Strobilomyces confusus	BZ, CR	M, E, GC	DR	CO
Strobilomyces strobilaceus	BZ*, CR	M, E, SW	C	
Suillus brevipes	BZ*	E, G, W	C	
Suillus decipiens	BZ, N	M, E, G	DR, C	
Suillus pseudoalbivelatus			DR*	
Suillus salmonicolor	BZ	E	DR	
Suillus tomentosus		NE, W	DR	
Tylopilus ballouii	BZ*, CR	M, NE, G	DR	
Tylopilus chromapes		E	DR	
Tylopilus violatinctus	BZ*, CR	NE, G		
Xerocomus belizensis	BZ*			
Xerocomus olivaceus	BZ*			
Xerocomus pseudoboletinus	BZ, N	SE		

Of the 14 species we found in the Dominican Republic, four are described as new (29%). A new record (*Austroboletus gracilis* var. *gracilis*) is added to the 12 species previously mentioned from the Dominican Republic, for a total of 17 boletes now known from the country. Ten of the boletes we found are also know from the eastern USA; one of these also occurs in the western USA (*Suillus tomentosus*; Table 2). These results confirm the biogeographic connections proposed by Halling (1996) and Halling and Mueller (2002) between North, Central and South American boletes. Based on phenotypic characters, they found that several agaric and bolete species have a north/south clinal distribution. They also mentioned the presence of relictual disjunct populations as well as local endemism. In our study, we also found affinities between North and Central American boletes. In addition, we found affinities

among boletes on the island of Hispaniola in the Caribbean with populations in eastern and western North America and Central America. Most of the species we found in Belize and the Dominican Republic are present in eastern North America, with just four species that also occur in western North America.

Key to the boletes from Belize

1. Hymenophore tubulose 2
1*. Hymenophore lamellate 50

2. Tubes yellow becoming olivaceous in maturity 3
2*. Tubes white or cream becoming vinaceous-pink or grayish in maturity 37

3. (2) Pores concolorous with tubes 4
3*. Pores discolorous with tubes and red or brown 27

4. (3) Hymenophore bruising blue 5
4*. Hymenophore not bruising blue 11

5. (4) Spores longitudinally striate 6
5*. Spores smooth 8

6. (5) Pileus tomentose, brown ..... ***Boletellus belizensis***
6*. Pileus with wooly scales, vinaceous pink or becoming cream color with age 7

7. (6*) Taste mild ..... ***Boletellus coccineus* var. *coccineus***
7*. Taste bitter ..... ***Boletellus coccineus* var. *amarus***

8. (5*) Pileus yellow or dark brown, taste mild 9
8*. Pileus pallid, taste bitter 10

9. (8) Stipe pulverulent, partial veil present ..... ***Pulveroboletus ravenelii***
9*. Stipe pruinose, partial veil absent ..... ***Boletus neotropicus***

10. (8*) Stipe yellow above, red below ..... ***Boletus inedulis***
10*. Stipe grayish buff to pink ..... ***Boletus pallidus***

11. (4*) Spores ornamented 12
11*. Spores smooth 14

12. (11) Spores alveolate-reticulate, basidiome coral red ..... ***Heimioporus ivoryi***
12*. Spores longitudinally striate, basidiome not coral red 13

13. (12*) Pileus surface glutinous ..... ***Boletellus singerii***
13*. Pileus surface tomentose becoming areolate ..... ***Boletellus cubensis***

14. (11*) Context white 15
14*. Context yellow 17

15. (14) Stipe reticulate ..... ***Boletus variipes* var. *fagicola***
15*. Stipe not reticulate 16

16. (15) Stipe with yellow floccosity, hymenophore golden yellow ..... ***Boletus* cf. *auriporus***
16*. Stipe longitudinally striate, hymenophore olive yellow ..... ***Boletus projectelloides***

17. (14*) Pores mainly circular 18
17*. Pores angular or radially elongated 22

18. (17) Stipe reticulate 19
18*. Stipe not reticulate 20

19. (18) Pileus and stipe yellow ..... ***Boletus aureissimus***
19*. Pileus brown, stipe yellow ..... ***Boletus auripes***

20. (18*) Stipe smooth, pileus rugulose ..... ***Boletus rugulosiceps***
20*. Stipe pruinose, pileus not rugulose 21

21. (20*) Pileus felty, brown ..... ***Boletus brunneotomentosus***
21*. Pileus tomentose, areolate, red ..... ***Boletus roseoareolatus***

22. (17*) Pileus mainly fibrillose becoming areolate 23
22*. Pileus mainly viscid or glutinous 25

23. (22) Hymenophore becoming deep olive green ..... ***Xerocomus olivaceus***
23*. Hymenophore golden yellow 24

24. (23*) Stipe with a reticulum, yellow brown with brown pruina ..... ***Xerocomus belizensis***
24*. Stipe lacking a reticulum, yellow bruising orange brown ..... ***Xerocomus pseudoboletinus***

25. (22*) Partial veil absent ..... ***Suillus brevipes***
25*. Partial veil present 26

26. (25*) Annulus ephemeral and dry, stipe fibrillose ..... ***Suillus decipiens***
26*. Annulus persistent and viscid, stipe glandular dotted ..... ***Suillus salmonicolor***

27. (3*) Pores orange, red or reddish brown 28
27*. Pores mainly brown 35

28. (27) Hymenophore and context bruising blue 29
28*. Hymenophore and context not bruising blue 33

29. (28) Stipe strongly reticulate ..... ***Boletus floridanus***
29*. Stipe weakly reticulate or pruinose/fibrillose 30

30. (29*) Stipe weakly reticulate or not, taste bitter ..... ***Boletus firmus***
30*. Stipe pruinose or fibrillose, taste not bitter 31

31. (30*) Pileus viscid, smooth, bright red ..... ***Boletus dupainii***
31*. Pileus dry, velvety or felty to rimulose 32

32. (31*) Pileus sepia, velvety ..... ***Boletus hypocarycinus***
32*. Pileus mahogany red becoming paler, felty to rimulose ..... ***Boletus mahoganicoloroides***

33. (28*) Stipe pruinose ..... ***Boletus guatemalensis***
33*. Stipe with a reticulum 34

34. (33*) Pileus felty, viscid, vinaceous to brick red ..... ***Boletus pseudofrostii***
34*. Pileus felty, pulverulent, orange yellow ..... ***Pulveroboletus auriflammeus***

35. (27*) Stipe mostly smooth or finely pruinose ..... ***Boletus vermiculosus***
35*. Stipe surface densely pruinose 36

36. (35*) Stipe pale horn color with drab to brown pruina ..... ***Boletus brunneopanoides***
36*. Stipe yellow with deep red or brownish red pruina ..... ***Boletus* cf. *caribaeus***

37. (2*) Spores ornamented 38
37*. Spores smooth 40

38. (37) Context white, unchanging ..... ***Austroboletus subflavidus***
38*. Context white bruising red to black 39

39. (38*) Spores reticulate ..... ***Strobilomyces strobilaceus***
39*. Spores sparassoid (broken reticulum) ..... ***Strobilomyces confusus***

40. (37*) Pileus appressed squamulose ..... ***Fistulinella conica***
40*. Pileus with different surface, not appressed squamulose 41

41. (40*) Stipe smooth 42
41*. Stipe ornamented 45

42. (41) Stipe stuffed, becoming chambered or hollow 43
42*. Stipe solid 44

43. (42) Pileus scaly, context bruising blue ..... ***Gyroporus* cf. *phaeocyanescens***
43*. Pileus felty, context not bruising blue ..... ***Gyroporus castaneus***

44. (42*) Pileus surface cinnamon to brown, bruising tawny olive ..... ***Tylopilus ballouii***
44*. Pileus surface gray or purple tinted, bruising dark purple ..... ***Tylopilus violatinctus***

45. (41*) Stipe scabrous 46
45*. Stipe reticulate 48

46. (45) Pileus dry, rivulose to scrobiculate, reddish brown ..... ***Leccinum* cf. *rugosiceps***
46*. Pileus viscid, pallid or white 47

47. (46*) Stipe context bruising vinaceous or yellow with greenish blue tints at base, scabers reddish brown to black ..... ***Leccinum* cf. *holopus* var. *americanum***
47*. Stipe context bruising grayish vinaceous to violet blue to indigo blue to dark fuscous with turquoise tints at base, scabers cream to dark brown ..... ***Leccinum violaceotinctum***

48. (45*) Pileus grayish olive, context yellow bruising dark yellow or orange yellow ..... ***Retiboletus ornatipes***
48*. Pileus grayish brown, context white to cream 49

49. (48*) Stipe cream or grayish with orange yellow stains ..... ***Retiboletus griseus***
49*. Stipe grayish white with a vinaceous red or rhubarb red stain ..... ***Retiboletus vinaceipes***

50. (1*) Pileus surface yellow brown ..... ***Phylloporus rhodoxanthus***
50*. Pileus surface reddish brown to tan 51

51. (50*) Stipe pruinose ..... ***Phylloporus boletinoides***
51*. Stipe recurved squamose ..... ***Phylloporus scabripes***

Key to the boletes from the Dominican Republic

1. Hymenophore yellow developing green or brown tints 2
1*. Hymenophore white, becoming grayish pink, gray or black 8

2. Spores longitudinally striate 3
2*. Spores smooth 4

3. (2) Pileus surface with wooly scales ..... ***Boletellus coccineus***
3*. Pileus surface velutinous to rimulose areolate ..... ***Boletellus domingensis***

4. (2*) Stipe with a reticulum ..... ***Boletus occidentalis***
4*. Stipe fibrillose or glandular dotted 5

5. (4*) Pileus glutinous 6
5*. Pileus tomentose or squamose 7

6. (5) Stipe with a persistent viscid annulus ..... ***Suillus salmonicolor***
6*. Stipe without annulus ..... ***Suillus pseudoalbivelatus***

7. (5*) Context bruising blue ..... ***Suillus tomentosus***
7*. Context not bruising blue ..... ***Suillus decipiens***

8. (1*) Context white, bruising orange red to black ..... ***Strobilomyces confusus***
8*. Context white, not bruising orange or black 9

9. (8*) Spores pitted 10
9*. Spores smooth 11

10. (9) Stipe longitudinally striate ..... ***Austroboletus gracilis***
10*. Stipe coarsely reticulate ..... ***Austroboletus subflavidus***

11. (9*) Stipe with a reticulum 12
11*. Stipe felty or scabrous 13

12. (11) Stipe with orange yellow stains ..... ***Retiboletus griseus***
12*. Stipe with vinaceous red stains ..... ***Retiboletus vinaceipes***

13. (11*) Pileus reddish orange or orange brown, stipe lacking scabers ..... ***Tylopilus ballouii***
13*. Pileus pinkish ocher to salmon, stipe with pinkish scabers ..... ***Tylopilus chromapes***

Description of species

Order *Boletales* E.-J. Gilbert
Suborder *Boletineae* Rea emend. E.-J. Gilbert
Family *Boletaceae* Chevall.
Genus *Austroboletus* (Corner) Wolfe

1. ***Austroboletus gracilis*** (Peck) Wolfe **var. *gracilis***, Bibl. Mycol. 69: 69 (1980). (Figs 1, 7)

Synonyms:
Boletus gracilis Peck, Ann. Rep. N. Y. State Museum 24: 78 (1872).
Tylopilus gracilis (Peck) Henn. in Engler & Prantl, Nat. Pfl.-Fam. 1(1**): 190 (1898).
Porphyrellus gracilis (Peck) Singer, Farlowia 2: 121 (1945).

Pileus 23 mm diam., broadly convex, velvety to pubescent, Brick Red (8-9E8) to Burnt Sienna (8F6-7), darkening in KOH, reddish brown in NH_4OH; margin decurved. *Context* white bruising pale pink, pale grayish vinaceous in KOH, negative in NH_4OH; 3 mm thick at center, 1.5 mm at margin. *Odor* and *taste* not determined. *Tubes* adnexed, 5 mm long, white becoming pale pink, negative in KOH and NH_4OH; *pores* nearly circular, 2-3/mm, white becoming pale pink. *Stipe* 55 mm long, 4 mm wide at apex, 6 mm at middle, 12 mm at base, tapered at apex with a bulbous base, longitudinally striate overall, ground color Light Russet Vinaceous (7C4-8C3) or Vinaceous Pink (8D4) with Walnut Brown (8E5) lines, bright orange brown in KOH, yellowish brown in NH_4OH. *Context* soft, white, not bruising, negative in KOH. *Basal mycelium* white. *Spore print* not obtained.

Basidiospores 11.2-14.4 × 4.8-6.4 µm (n = 20; 12.5 ± 1.25 × 5.55 ± 0.63; Q_m = 2.28 ± 0.17), ellipsoid, smooth to slightly pitted, greenish yellow in KOH, dextrinoid in Melzer's solution. *Basidia* 34.4-44 × 11.2-12 µm, clavate, 4-sterigmate. *Basidioles* 19.2-44 × 6.4-12 µm, clavate. *Pleurocystidia* 56-68 × 6.4-13.6 µm, cylindrical, cylindrical-fusoid, fusoid-ventricose, septate. *Cheilocystidia* 72-84 × 8.8-10.4 µm, cylindrical, septate; individual elements cylindrical to subclavate. *Pileipellis* an entangled trichodermium of erect

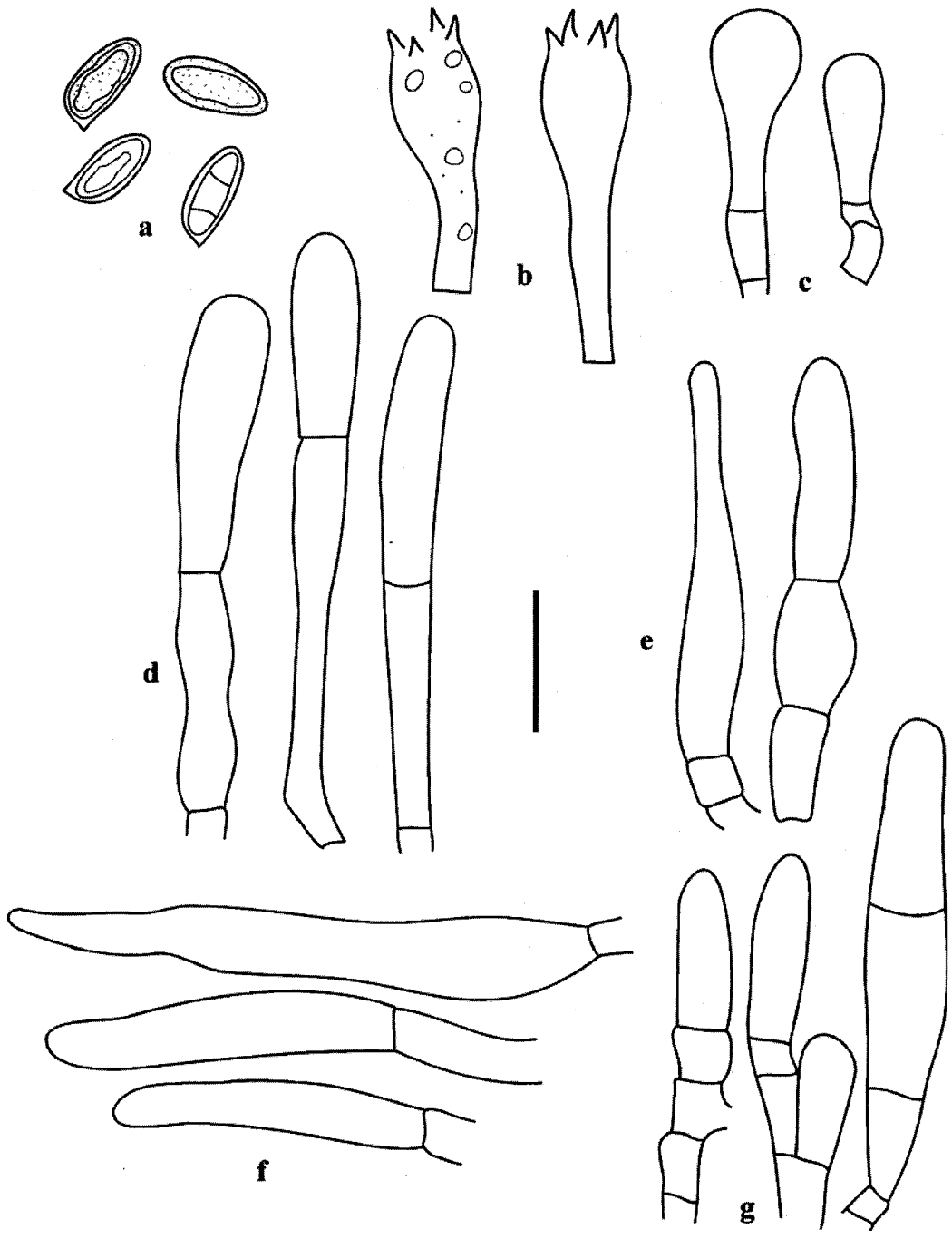


Fig. 1. *Austroboletus gracilis* var. *gracilis*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia. **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 496*. Scale bar = 20 µm.

hyphae 3.2-16 µm diam., hyaline in KOH; end cells 43.2-80 × 7.2-11.2 µm, cylindrical, sublanceolate or cylindric-ampullaceous; some with a subacute or subcapitate apex, hyaline in KOH. *Stipitipellis* hyphae interwoven 3.2-13.6 µm diam., hyaline in KOH, giving rise to clusters of *caulocystidia*; these 13.6-40 × 4.8-10.4 µm, septate; individual elements cylindric-fusoid.

Habitat: Solitary under *Pinus occidentalis*.

Known distribution: Eastern Canada to Florida, west to Tennessee, Michigan and south to Mexico in North America; Costa Rica in Central America; the Dominican Republic in the Caribbean (first report for the Caribbean).

Material examined: DOMINICAN REPUBLIC. La Vega Province: Los Dajaos, ridge road above Manabao, ca. Finca de José Cruz, 19°4'46"N, 70°48'11"W, 823 m asl, 5 January 2003, *BOS 496*, DR 2520 (JBSD, CFMR).

Notes: *Austroboletus gracilis* var. *gracilis* is distinguished by the reddish brown tones over the pileus and stipe surfaces, a white hymenophore that becomes pink at maturity, a white context, the long and longitudinally striate stipe and the pitted spores. This variety differs from *A. gracilis* var. *pulcherripes* Both & Bessette in the maroon or reddish brown surface colors rather than dark brown or orange brown and in the absence of the stipe reticulum. *Austroboletus gracilis* var. *flavipes* T.J. Baroni, Halling & Both has yellow tints overall, a pruinose stipe without ribs or reticulum and smaller basidiospores (11.2-14 × 5-6.5 µm vs. 10-17 × 5-8 µm). Our collection differs from those described by Smith and Thiers (1971) in having longer basidia (34.4-44 µm vs. 24-36 µm) and pleurocystidia (56-68 µm vs. 35-50 µm), and its spores are smooth to minutely pitted.

2. ***Austroboletus subflavidus*** (Murrill) Wolfe, Bibl. Mycol. 69: 67 (1979). (Figs 2, 8)

Synonyms:
Tylopilus subflavidus Murrill, Mycologia 30: 521 (1938).
Boletus subflavidus (Murrill) Murrill, Mycologia 30: 525 (1938).
Boletellus subflavidus (Murrill) Snell, Mycologia 33: 422 (1941).
Porphyrellus subflavidus (Murrill) Singer, Farlowia 2: 120 (1945).

Pileus 19 (-72) mm diam., broadly convex, pubescent, not or slightly viscid when wet, pale Spectrum Yellow (3A8) to pastel yellow. *Context* white not bruising. *Odor* none to fungoid. *Taste* none (bitter in one collection). *Tubes* adnexed, 5-6 mm long, Vinaceous Pink (8D4) to vinaceous brown; *pores* nearly circular, 2-3/mm, concolorous with tubes or pinkish gray. *Stipe* 30 (-100) mm long, 4.7 (-20) mm wide, slightly ventricose or expanded in lower 1/3, with tapered base, with a strong and coarse reticulum overall, pale yellow. *Basal mycelium* white. *Spore print* not obtained. *Macro-chemical* reactions not obtained.

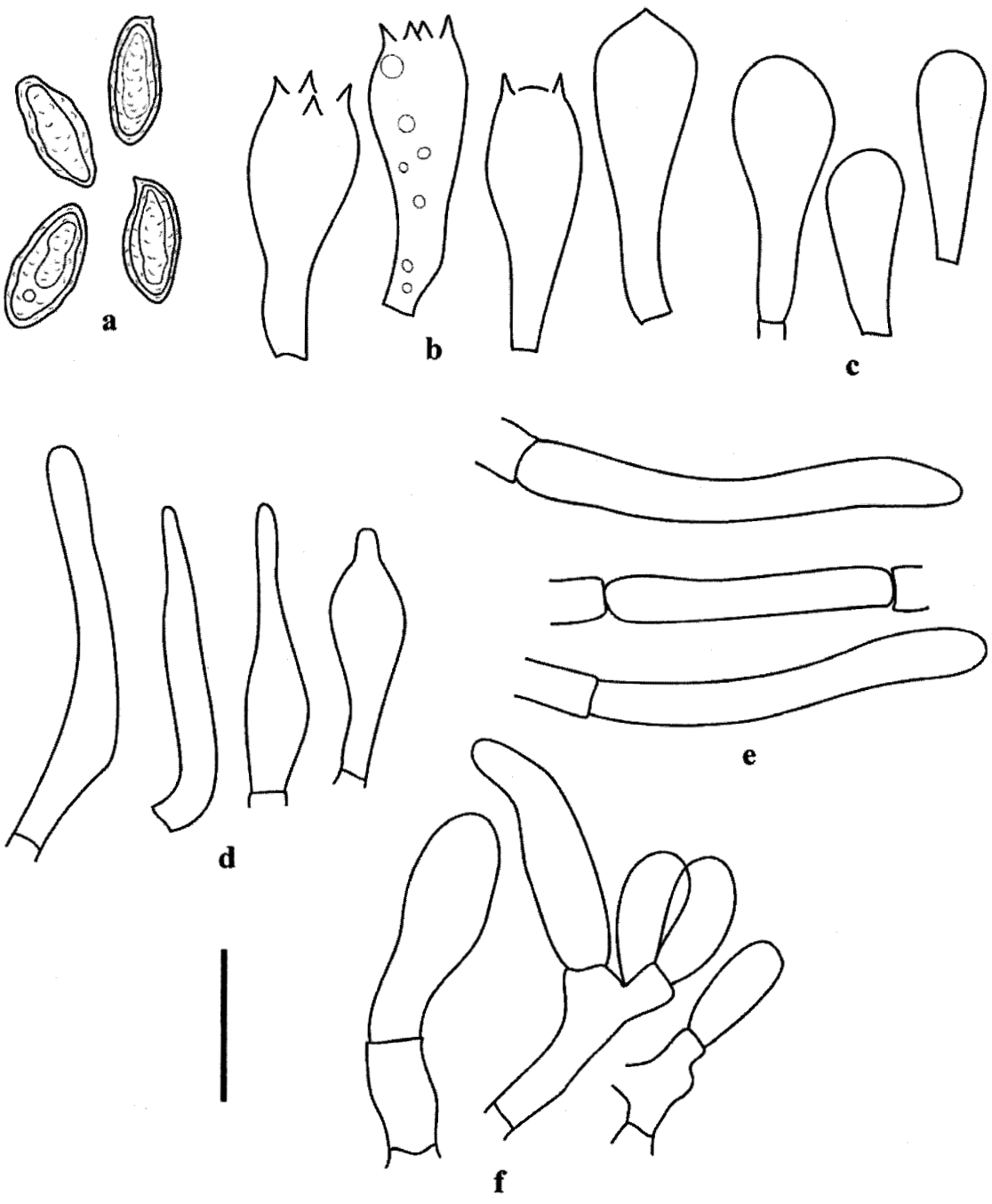


Fig. 2. *Austroboletus subflavidus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** End-cells of pileipellis; **f.** Caulocystidia. *DJL-BZ-27.* Scale bar = 20 μm.

Basidiospores 13.6-18.4 (-20.8) × 4.8-8 (-8.8) µm (n = 20; 16.17 ± 1.82 × 6.97 ± 1.03; Q_m = 2.42 ± 0.41), subfusiform, pitted, thick-walled, greenish yellowish-brown in KOH. *Basidia* (28-) 33.6-40 × 8.8-12.8 µm, clavate, (1-2) 4-sterigmate. *Basidioles* 24-36.8 × 8.8-9.6 (-12.8) µm, clavate. *Pleurocystidia* 25.6-52 × 4.8-8 (-9.6) µm, fusoid, scattered. *Pileipellis* an entangled trichodermium of suberect to erect hyphae 3.2-11.2 µm diam., some with guttules, hyaline in KOH, yellow in Melzer's; end cells cylindrical, some moderately thick-walled. Hyphae from the reticulum 2.4-8 µm diam., interwoven, multi-septate, hyaline in KOH; giving rise to clusters of *caulocystidia*, these 15.2-32 × 5.6-10.4 µm, clavate, hyaline in KOH.

Habitat: Solitary under *Pinus caribaea*, *P. occidentalis* and *Quercus* spp.

Known distribution: New Jersey to Florida, west to Mississippi, south to Mexico in North America; Belize and Costa Rica in Central America; the Dominican Republic in the Caribbean.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 18 October 2002, *DJL-BZ-27*, BZ 1824 (BRH, CFMR); 14 October 2003, *BOS 625*, BZ 3178 (CFMR). DOMINICAN REPUBLIC. Santiago Province: Las Placetas, near San José de las Matas, 19°13'27"N, 70°53'27"W, 1100 m asl, 28 January 1998, *DJL-DR-48*, DR 592 (JBSD, CFMR); La Vega Province: Jarabacoa, Golf Course, 13 November 2003, *TJB 9787*, DR 2859 (JBSD, CORT, CFMR).

Notes: *Austroboletus subflavidus* is characterized by the yellow colors of the basidiocarp, a stipe with a coarse reticulum and pitted spores. Our collections differ from those described by Singer (1945a) in having smaller pilei (19-72 mm vs. 47-107 mm diam.), fewer cystidia and smaller caulocystidia (15.2-32 × 5.6-10.4 µm vs. 38 × 11.3-11.5 µm).

Genus *Boletellus* Murrill

3. ***Boletellus belizensis*** B. Ortiz & T.J. Baroni, **sp. nov.** (Figs 3, 9)

MycoBank: 511045

Etymology: *belizensis* - from Belize.

Pileus convexus, tomentosus, atrorubiginosus. *Contextus* luteolus, caerulescens demum glaucescens. *Tubi* flavi demum olivaceo-viridi, adnati, statim caerulescens, *pori* concolores, caerulescens. *Stipes* ochraceus vel auratus, pruinosus, intus flavidus, caerulescens. *Boletellus chrysenteroides* affinis, sporae longitudinaliter striatus sed striae transversalis absunt.

Pileus 24-40 mm diam., convex, tomentose at first, with expansion becoming a soft loose tomentum (wooly to the touch), dark reddish brown (6-7F6-7), paler at margin (6E6-7), becoming much paler with expansion; ground color grayish yellow brown (between 4A4 and 4B4), reddish brown in KOH and NH_4OH. *Context* pale yellow becoming instantly bright blue when exposed, then fading to dull bluish green, brown in KOH, greenish yellow to greenish brown in NH_4OH. *Odor* none. *Taste* slightly acidulous. *Tubes* adnate or shallowly depressed, yellow to olive green, bluing instantly when exposed,

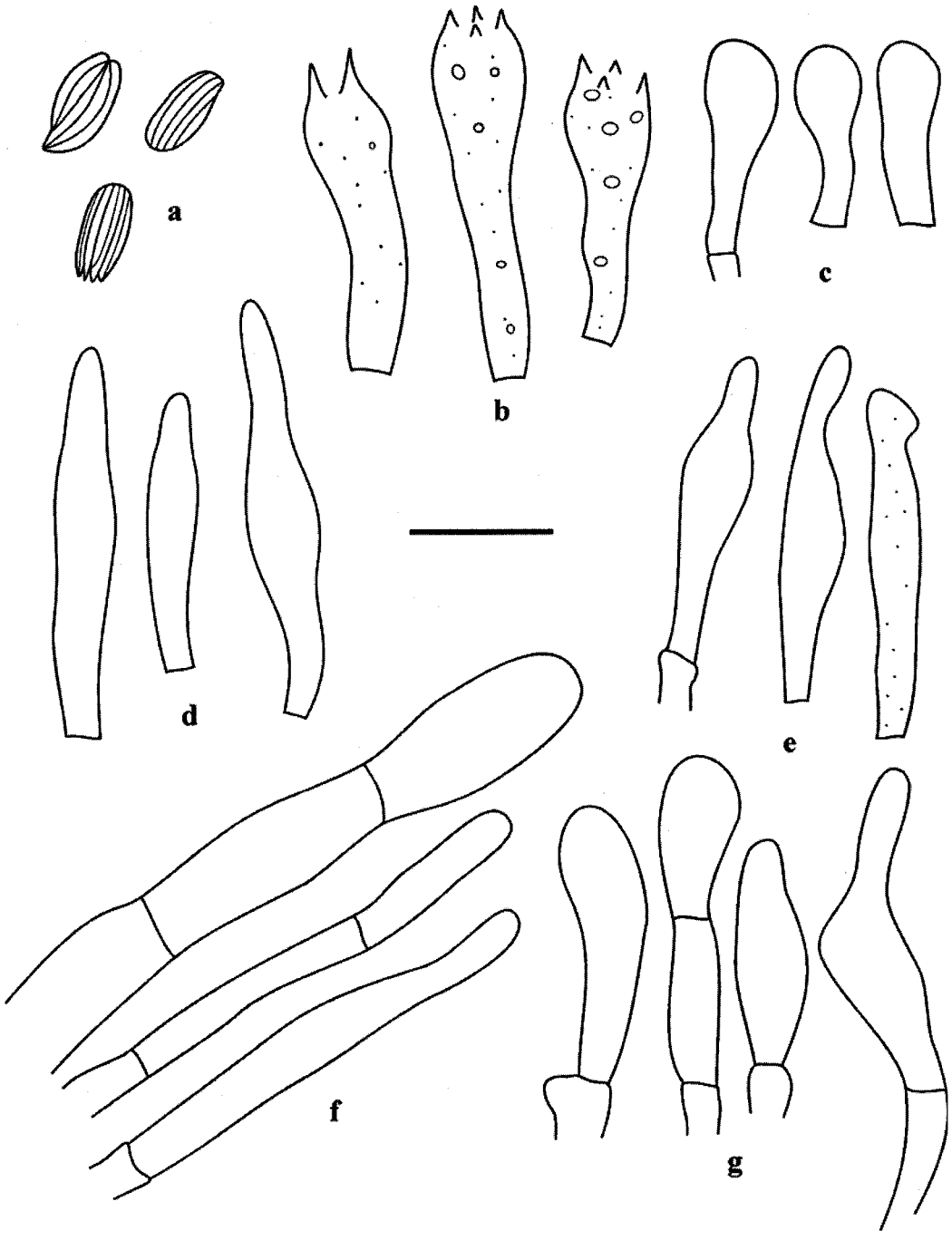


Fig. 3. *Boletellus belizensis*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *TJB 9128*. Scale bar = 20 µm.

reddish brown in KOH, greenish brown in NH_4OH; *pores* circular becoming somewhat angular with age, 1-1.5/mm, yellow (3A4) at first becoming dull olive green (3B4-5). *Stipe* 60-70 mm long, 7-8 mm wide, equal to subclavate, terete, pruinose above, ± furfuraceous-bumpy over the lower 1/3, dark brown below, paler ochre to bright yellow (4A5 to 3A4) over upper part, overlain with pale brown to reddish brown pruina; pruina dark brown toward the base; base with creamy ochre mycelioid base, staining deep brown when handled, brownish yellow to reddish brown in KOH, negative in NH_4OH. *Context* solid, deep golden yellow, turning deep blue with exposure, pale brown in KOH, negative in NH_4OH. *Spore print* not obtained.

Basidiospores 12-14.4 × 5.6-7.2 µm (n = 20; 13.16 ± 0.8 × 6.42 ± 0.69; Q_m = 2.07 ± 0.18), ellipsoid, longitudinally winged, projecting up to 2 µm, lacking transverse striations, yellowish brown in KOH. *Basidia* 36-48 × 10.4-12 µm, clavate, (2-) 4-sterigmate, some with golden yellow contents in KOH. *Basidioles* 24.8-28.8 × 8.8-9.6 µm, clavate. *Pleurocystidia* 37.6-57.6 × 5.6-8.8 µm, fusoid-ampullaceous, numerous. *Cheilocystidia* 41.6-49.6 × 6.4-8.8 µm, fusoid or fusoid ventricose, some encrusted, with golden yellow contents in KOH and Melzer's. *Pileipellis* a tangled layer of suberect hyphae 4.8-15.2 µm diam., multi-septate with short to elongated segments, encrusted pigments dark brown in H_2O, diffusing with the application of KOH, producing reddish orange to orange brown to pale orange color reactions; hyaline or with pale grayish yellow or golden yellow contents in KOH, yellowish brown in Melzer's; end cells 20-64 × 8-12.8 µm, cylindrical, some thick-walled. *Stipitipellis* hyphae 3.2-13.6 µm diam., parallel, multi-septate, grayish yellow in KOH. *Caulocystidia* 20-88.8 × 9.6-12.8 µm, clavate, fusoid, lageniform, with grayish yellow or yellowish brown contents in KOH.

Habitat: Gregarious on humus under *Quercus peduncularis* and *Quercus* spp.

Distribution: Belize.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at the Tropical Education Center, 17°21'27"N, 88°32'30"W, 23 m asl, 26 July 2002, *BOS 218*, BZ 1564 (CFMR). Cayo District: Mountain Pine Ridge Forest Reserve, Five Sisters Lodge, Nature Trail, 17°2'16"N, 88°59'8"W, 308 m asl, 9 August 2001, *TJB 9126*, BZ 314 (CORT, CFMR); *TJB 9127*, BZ 315 (CORT, CFMR); *TJB 9128,* BZ 316 (CORT, **holotype**; CFMR, **isotype**); *JCB 2001-238*, BZ 429 (CFMR).

Notes: *Boletellus belizensis* is distinguished by a tomentose reddish brown pileus that becomes paler with age, a yellow context and yellow hymenophore that turned blue when exposed or bruised, a pruinose stipe with yellow ground and reddish brown to brown pruina and spores longitudinally (but not transversely) striate. It belongs to Section *Chrysenteroidei*, similar to *Boletellus chrysenteroides* (Snell) Singer and *B. fallax* (Singer) Singer.

Boletellus chrysenteroides has a deep brown pileus, its spores are striate both longitudinally and transversely and it has smaller pileipellis end cells (17-18 × 5.8-9.8 µm vs. 20-64 × 8-12.8 µm). *Boletellus fallax* has a scaly or shaggy-scaly pileus and stipe surfaces that are colored dark brown, it has shorter basidia (25-39 µm vs. 36-48 µm) and wider pleurocystidia (10-14.2 µm vs. 5.6-8.8 µm). *Boletellus domingensis* B. Ortiz & Lodge differs in having a dark brown pileus lacking red tints and the stipe context turns red instead of blue when it is exposed.

4. ***Boletellus coccineus*** (Fr.) Singer **var. *coccineus***, Beih. Nova Hed. 105: 6 (1992). (Figs 4, 10)

Synonyms:
Boletus coccineus Plum ex Fr., Epicrisis, 423 (1838).
Strobilomyces coccineus (Fr.) Sacc., Syll. 6: 50 (1888).
Boletus ananas M.A. Curtis, Amer. Journ. Sci. II. 6: 251 (1848).
Boletellus ananas (M.A. Curtis) Murrill, Mycologia 1: 10 (1909).

Pileus 70-105 mm diam., convex, uplifted squamose, with wooly squarrose scales, becoming rimose scaly, not viscid; ground color yellowish cream (4A2) to burgundy (11C8) with pink or cream to pale greenish brown (4C4) scales, reddish brown in KOH, negative or brown in NH_4OH; margin incurved, appendiculate, forming triangular lobes. *Context* soft, yellowish cream, bruising blue, negative or bright yellow in KOH, negative in NH_4OH; 19 mm thick at center, 3 mm at margin. *Odor* not determined. *Taste* sweet. *Tubes* free to sinuate, depressed around stipe, 5-25 mm long, mustard yellow (3B6), bruising blue quickly, yellowish brown or reddish brown in KOH, negative or pale brown in NH_4OH; *pores* circular to angular, 1-2/mm, concolorous with tubes becoming red with age, bruising blue. *Stipe* 60-135 mm long, 8-30 mm wide at apex, 8-17 mm at middle, 8-16 mm at base, equal or slightly bulbous, fibrillose; the youngest one with appressed squamules in the middle; yellow at apex with a pink (11A6) ring or zone below it, cream to buff (4B4) below, with brownish green (4C4) fibrils overall, yellowish brown or brown in KOH, negative in NH_4OH. *Context* fibrous, solid, yellowish cream turning blue slowly. *Basal mycelium* white; pale yellow to pale brown in KOH, negative in NH_4OH. *Spore print* not obtained.

Basidiospores (8.4-) 10.4-19.2 × 6.4 (-8.8) µm (n = 20; 16.71 ± 1.93 × 7.46 ± 0.85; Q_m = 2.22 ± 0.22), subfusoid, longitudinally winged, projecting up to 1.2 µm and transversely striate, yellowish brown in KOH. *Basidia* 24.8-44.8 × 13.6-16 µm, clavate, 4-sterigmate. *Basidioles* 27.2-41.6 × 8.8-15.2 µm, clavate. *Pleurocystidia* 44-91.2 × 8-14.4 µm, fusoid-ampullaceous, fusoid-mucronate, ventricose-ampullaceous or ventricose rostrate, pale grayish yellow or with yellowish brown contents in KOH. *Cheilocystidia* 45.6-60 × 9.6-13.6

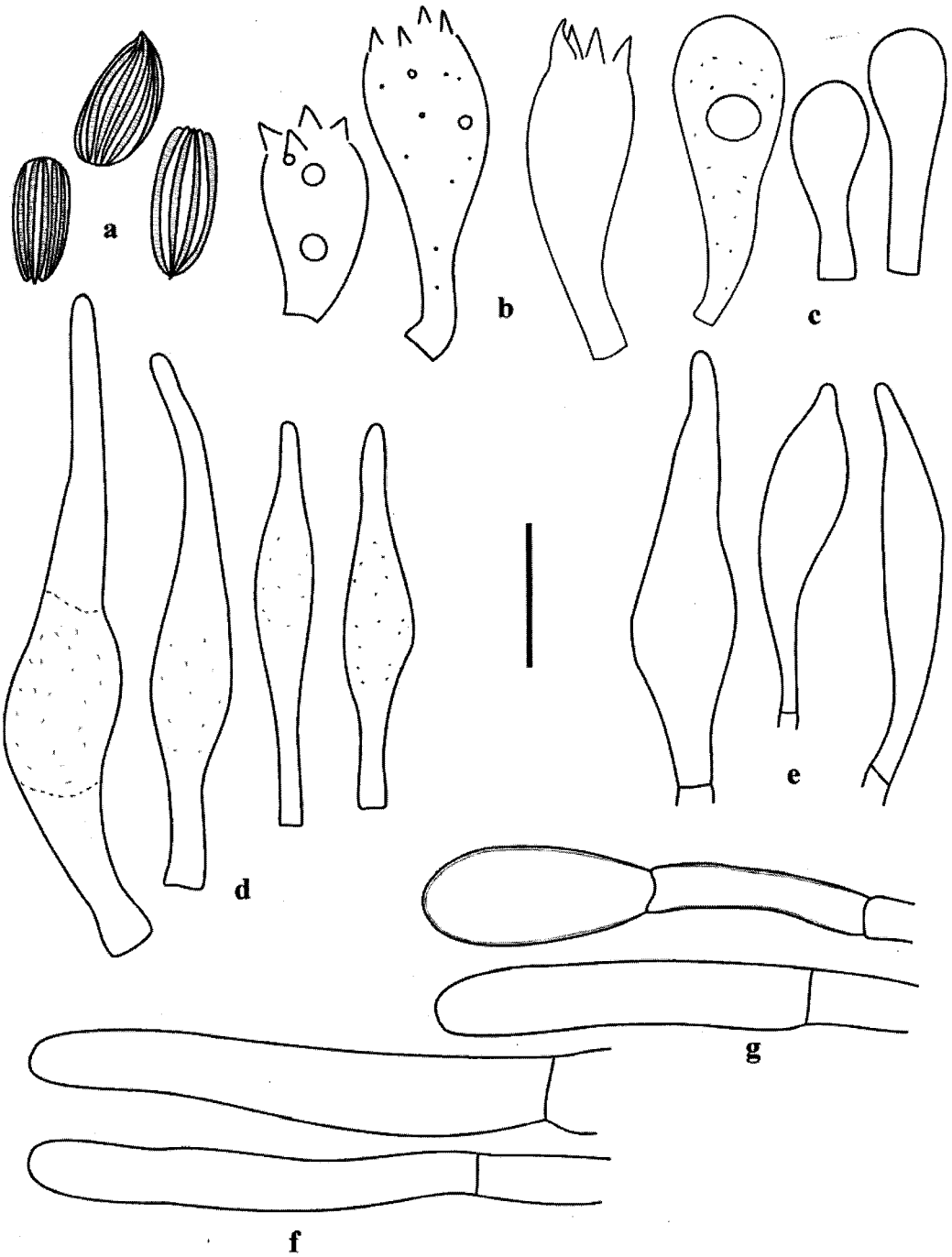


Fig. 4. *Boletellus coccineus* var. *coccineus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** End-cells of stipitipellis. *BOS 127*. Scale bar = 20 μm.

µm, fusoid, fusoid-mucronate, or ventricose rostrate; some with yellowish brown contents in KOH. *Pileipellis* consisting of a tightly tangled layer of elongated repent hyphae 4-18.4 µm diam., hyaline or with grayish yellowish-brown or pale orange brown contents in KOH; end cells cylindrical. *Stipitipellis* hyphae 4-14.4 µm diam., interwoven or subparallel, hyaline or with pale grayish yellow contents in KOH, some brighter than others. *Caulocystidia* absent.

Habitat: Caespitose or gregarious under *Pinus caribaea*, *P. occidentalis* and *Quercus* spp.

Known distribution: North Carolina to Florida, west to Texas and south to Mexico in North America; Belize, Guatemala and Costa Rica in Central America; Colombia in South America; Cuba and the Dominican Republic in the Caribbean.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at the Tropical Education Center, 17°21'27"N, 88°32'30"W, 23 m asl, 19 July 2002, *BOS 197*, BZ 1543 (BRH, CFMR); 28 July 2002, *BOS 227*, BZ 1573 (BRH, CFMR). Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, Forestry Station, camp ground, 16°58'22.9"N, 88°59'44"W, 456 m asl, 10 August 2002, *BOS 258*, BZ 1603 (BRH, CFMR). DOMINICAN REPUBLIC. La Vega Province: Jarabacoa, road to Salto de Jimenoa, 19°5'57"N, 71°35'53"W, 6 January 2003, *BOS 503*, DR 2527 (JBSD, CFMR).

Notes: *Boletellus coccineus* var. *coccineus* is distinguished by the pink to burgundy woolly-squarrose scales on pileus surface, the fibrillose stipe with a pink-red zone at apex and the longitudinally winged and transversely striate spores. It differs from *B. coccineus* var. *amarus* Singer in the stipe surface which is fibrillose instead of laciniate-reticulate, and its taste is not bitter. Our collections have longer hymenial cystidia (44-91.2 µm vs. 24-50 µm) than those described by Singer (1945a) and Singer *et al.* (1983) for *B. coccineus* var. *coccineus*.

5. ***Boletellus coccineus* var. *amarus*** Singer, Beih. Nova Hed. 105: 8 (1992). (Figs 5, 11)

Pileus 29-54 mm diam., hemispheric to convex, appressed squamose with wooly scales, not viscid, Vinaceous (11B5) to Flesh Color (7B3) to Light Russet Vinaceous (7C4-8C3), white to pale grayish vinaceous at margin, bruising blue, reddish brown in KOH, negative in NH_4OH; margin incurved, appendiculate, strongly projecting. *Context* pale yellow, bruising blue, becoming Pearl Gray (4C1-2), pink to red in KOH, negative in NH_4OH. *Odor* not distinctive. *Taste* very bitter. *Tubes* adnexed or shallowly depressed near stipe, 4-7 mm long, Sulphur Yellow (3B5), bruising blue, pale red in KOH, negative in NH_4OH; *pores* nearly circular to irregular, labyrinthine, 2/mm, concolorous with tubes, bruising blue. *Stipe* 60-85 mm long, 9-14 mm wide at

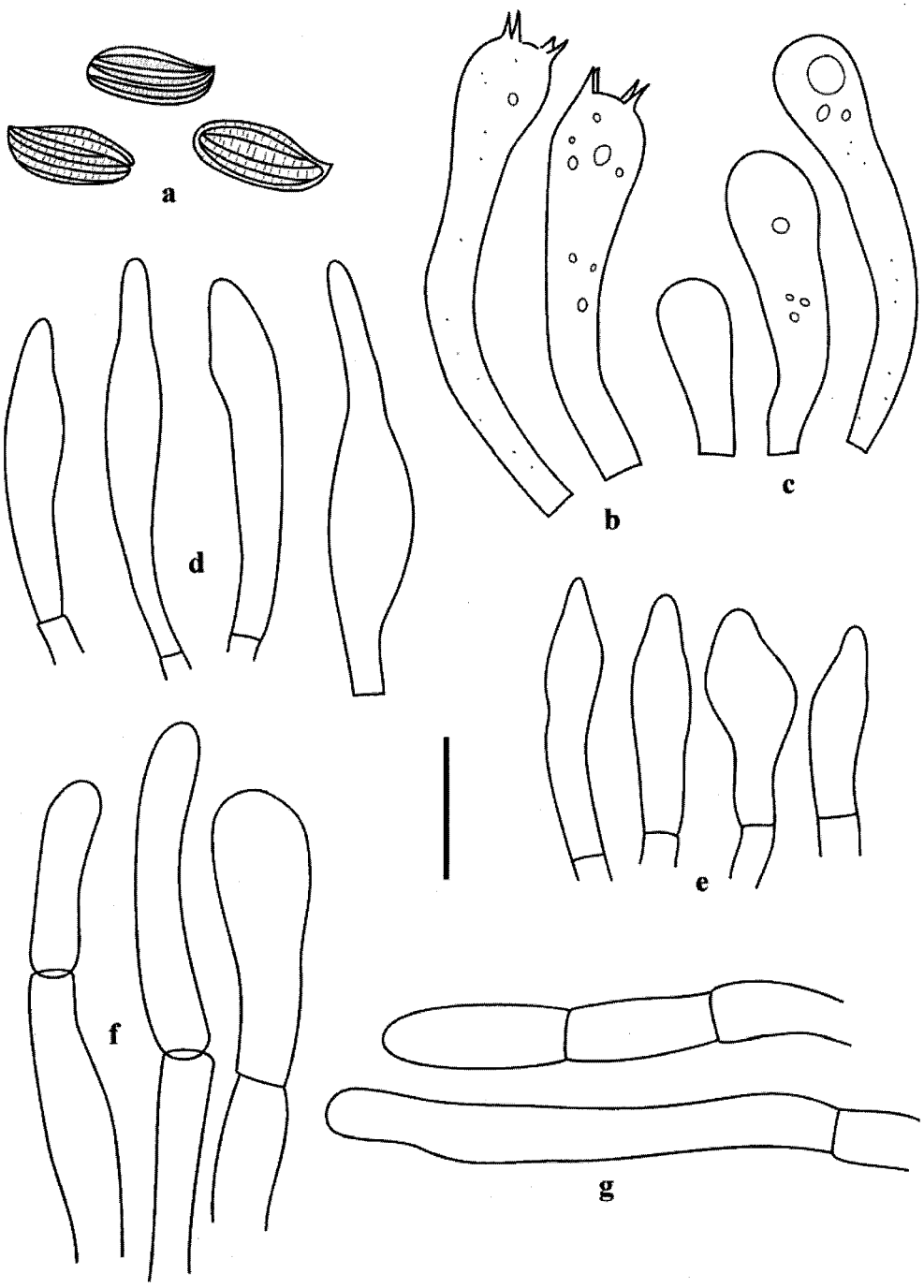


Fig. 5. *Boletellus coccineus* var. *amarus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** End-cells of stipitipellis. *BOS 244*. Scale bar = 20 µm.

apex, 11-17 mm at middle, 13-22 mm at base, clavate, fibrillose above, tomentose to recurved squamulose below; ground color white with a yellow and pale grayish vinaceous zone at apex, bruising Clay Color (5D5) to Verona Brown (6E7), bright yellow in KOH, negative in NH_4OH. *Context* fibrous, hard at base, white, bruising Clay Color (5D5) or pale grayish vinaceous, bright yellow in KOH, negative in NH_4OH. *Basal mycelium* white, becoming pale grayish vinaceous after bruising. *Partial veil* fibrillose, thick, white then pale grayish vinaceous. *Spore print* Army Brown.

Basidiospores 15.2-20 × 6.4-7.2 µm (n = 20; 17.82 ± 1.21 × 6.76 ± 0.41; Q_m = 2.64 ± 0.23), fusoid, longitudinally winged, projecting up to 1.5 µm and finely transversely striate, yellow to yellowish brown in KOH. *Basidia* 52-70.4 × 11.2-12 µm, clavate, cylindric-clavate, 4-sterigmate. *Basidioles* 24-60 × 10.4-12 µm, clavate, cylindric-clavate. *Pleurocystidia* 40.8-60 × 6.4-12 µm, fusoid, fusoid-ventricose, cylindric, clavate. *Cheilocystidia* 26.4-38.4 × 7.2-11.2 µm, fusoid-ventricose, some slightly ampullaceous or sublanceolate. *Pileipellis* a tangled layer of repent elongated hyphae 4-16 µm diam., with bright grayish yellow contents in KOH; end cells cylindrical or irregularly shaped. *Stipitipellis* hyphae 4-11.2 µm diam., interwoven to subparallel, multi-septate, hyaline or with pale grayish yellow contents in KOH; end cells cylindrical.

Habitat: Gregarious under *Pinus caribaea.*

Known distribution: Belize, Honduras and Costa Rica in Central America; the Bahamas Islands in the Caribbean.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at the Tropical Education Center, 17°21'27"N, 88°32'30"W, 23 m asl, 6 August 2002, *BOS 244*, BZ 1590 (BRH, CFMR).

Notes: *Boletellus coccineus* var. *amarus* is distinguished by the vinaceous tones of the scaly pileus surface, the bitter taste and the ornamented stipe, described by Singer *et al.* (1992) as laciniate-reticulate. Our collection has a bitter taste but the stipe is more tomentose-floccose, forming recurved-scales but not a reticulum. It also differs from those described by Singer *et al.* (1992) in the pileus context color, which is pale yellow instead of white.

6. ***Boletellus cubensis*** (Berk. & M.A. Curtis) Singer, Farlowia 2: 127 (1945). (Figs 6, 12)

Synonyms:
Boletus cubensis Berk. & M.A. Curtis, Journ. Linn. Soc. 10: 304 (1868).
Boletus lignatilis Berk. & M.A. Curtis. l.c. 10: 303 (1868).

Pileus 37 mm diam., convex, areolate, strongly tomentose on areoles, glabrous or matted in cracks; ground color pale pink with Plumbeous Gray to dark grayish brown (6D-E2) areoles, showing pale sordid white with some blush pink (7B3-7A2) in cracks between areoles; margin not projecting.

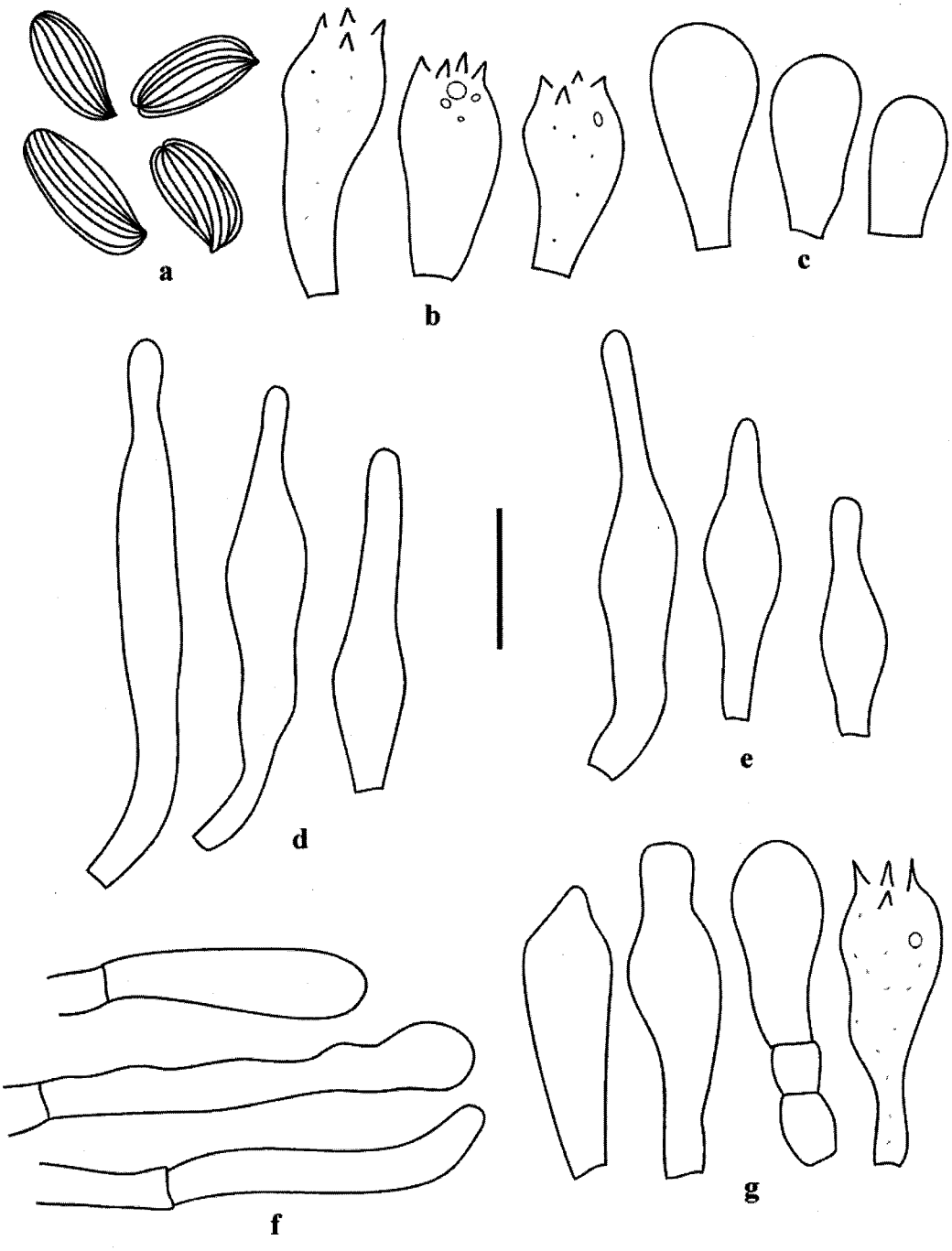


Fig. 6. *Boletellus cubensis*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia and dermatobasidia. *TJB 9954*. Scale bar = 20μm.

Context lemon yellow (2A3-4) with pale creamy white areas; 9 mm thick at center. *Odor* not distinctive. *Taste* not determined. *Tubes* adnexed or narrowly sinuate, 9 mm long, Olive Yellow (2C5), not bruising; *pores* slightly radiate angular, 1/mm, concolorous with tubes, not bruising. *Stipe* 50 mm long, 8 mm wide, sub-clavate to clavate, ground color sordid white or pale grayish but covered mostly with peronate dark gray brown flattened-floccose fibrillose patches to near tubes, at apex and about 15 mm down the stipe with appressed rhubarb (11B6-7) fibrils over pale grayish ground color. *Context* solid, yellow at stipe apex and in pileus, white over lower 2/3 of stipe. *Spore print* not obtained. *Macro-chemical reactions* not obtained.

Basidiospores 15.2-18.4 (-20.8) × 7.2-9.2 µm (n = 20; 17.44 ± 1.55 × 7.49 ± 0.50; Q_m = 2.20 ± 0.20), fusiform, longitudinally winged; wings projecting up to 1.5 µm, lacking transverse striations, yellowish brown in KOH and Melzer's, with dark brown wall. *Basidia* 25.6-38.4 × 13.6 µm, clavate, 4-sterigmate. *Basidioles* 20-32 × 9.6-14.4 µm, clavate or obpyriform. *Pleurocystidia* 48-76 × 8-10.4 µm, few, cylindric-fusoid, fusoid-ampullaceous, sublageniform. *Cheilocystidia* 33.6-64 × 8.8-10.4 µm, fusoid, fusoid ventricose, ventricose rostrate; some thick-walled. *Pileipellis* a tangled layer of repent or erect hyphae 3.2-10.4 µm diam., with golden yellow or bright orange-yellow contents in KOH; end cells 31.2-60 × 5.6-10.4 µm, cylindrical or clavate. *Stipitipellis* hyphae 3.2-9.6 µm diam., interwoven or parallel, hyaline in KOH; giving rise to clusters of *caulocystidia*, these 17.6-48 × 11.2-16.8 µm, clavate, fusoid-ventricose or lageniform; *dermatobasidia* 40-46 × 9.6-13.6 µm, clavate, cylindric-clavate, 4-sterigmate.

Habitat: Solitary in sandy soil under *Coccoloba uvifera* in Belize.

Known distribution: Mexico in North America; Belize and Costa Rica (Gómez, 1996) in Central America; Cuba in the Caribbean.

Material examined: BELIZE. Belize District: Ambergris Caye, S., S. of San Pedro near Tara del Mar Resort, 17°53'25"N, 87°58'51.7"W, 3 m asl, 23 November 2004, *TJB 9954*, BZ 3964 (CORT, CFMR). BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Kropp 1-August-03-9 (NY).

Notes: *Boletellus cubensis* is characterized by the pink tones over the pileus and stipe surfaces, the tomentose pileus that becomes areolate with time and the longitudinally winged spores. These collections agree with those described by Singer et al. (1992), differing in the color of the exposed context of the pileus, which is pink rather than cream.

7. ***Boletellus domingensis*** B. Ortiz & Lodge, **sp. nov.** (Figs 13, 19)
MycoBank: 511046

Etymology: *domingensis* - from the Dominican Republic or the island of Hispaniola (known classically as Santo Domingo) where it was found.

Pileus campanulatus vel planus, velutinus demum rimuloso-aerolatus, brunneus. *Contextus* luteolus, celeriter caerulescens. *Tubi* aurei, adnexi, caerulescens, *pori* concolores demum olivacei, caerulescens. *Stipes* brunneus, pruinosus, intus flavidus, ubi contusi rubro-brunneus. *Boletellus chrysenteroides* affinis, sporae longitudinaliter striatus sed striae transversalis absunt.

Pileus 18-60 mm diam., hemispheric, broadly campanulate or plane, velutinous, rimulose-areolate, dry, dull, Van Dyke Brown (7F3-4), Brussels Brown, Dark Drab (5E4) to Hair Brown (5F5) or Mikado Brown (6D4-5) to Verona Brown (6E7); exposed context Buff (4B4) or Pale Pinkish Buff (5B3); margin decurved. *Context* pale yellow or Pale Pinkish Buff (5B3), turning quickly blue when exposed, fading slowly. *Odor* and *taste* not distinctive. *Tubes* adnexed, 3-7 mm length, Spectrum Yellow (3A8) or deep Straw Yellow (3B4) becoming Olive Yellow (2C5), bruising blue; *pores* angular, 1-2/mm, concolorous with tubes, becoming Buff (4B4), Walnut Brown (8E5), Mars Brown (7F8), Cinnamon (5C4), Raw Umber (5E5-6) or Brick Red (8-9E8) with age, bruising blue. *Stipe* 27-55 mm long, 4-12 mm wide, equal, minutely pubescent or pruinose, Dark Drab (5E4) to Light Drab (5D3) above, Cinnamon Drab (7D4) below, with Sayal Brown (6D5) to Prout's Brown (7F4) areas. *Context* yellow, or Tawny Olive (5C4) to Sayal Brown (6D5) in some areas, becoming Mahogany Red (8D6) to Brick Red (8-9E8) when exposed. *Spore print* not obtained. *Macro-chemical reactions* not obtained.

Basidiospores 12.8-16 × 5.6-8 µm (n = 20; 14.16 ± 1.27 × 6.6 ± 1.03; Q_m = 2.17± 0.20), ellipsoid, with fine longitudinal (but not transversely) striations, golden yellow or yellowish brown in KOH. *Basidia* 33.6-60.8 × 10.4-16 µm clavate or broadly clavate, 4-sterigmate. *Basidioles* 29.6-48.8 × 8-15.2 µm, cylindrical, clavate or broadly clavate. *Cystidia* 44.8-84 × 8-11.2 µm, fusoid, fusoid-ampullaceous. *Pileipellis* a tangled layer of suberect hyphae 4.8-14.4 µm diam., multi-septate, encrusted pigments dark brown or reddish brown in H_2O, diffusing with the application of KOH, producing a reddish orange to pale grayish orange color reactions; hyaline or with grayish yellow to golden yellow contents in KOH, yellowish brown to reddish brown in Melzer's; end cells 36-61.6 × 5.6-8.8 µm, cylindrical to subfusoid with grayish yellow or pale yellowish brown contents in KOH. *Stipitipellis* hyphae 4.8-16.8 µm diam., parallel, interwoven in some areas. *Caulocystidia* 52-98.4 × 9.6 µm, fusoid to lageniform or fusoid-ampullaceous, some septate, pale grayish yellow in KOH.

Habitat: Gregarious under *Pinus occidentalis*.

Known distribution: Dominican Republic.

Material examined: DOMINICAN REPUBLIC. Santiago Province: Las Placetas, near San José de las Matas, 19°13'27"N, 70°53'27"W, 1100 m asl, 28 January 1998, *DJL-DR-28,* DR 572 (JBSD, CFMR); *DJL-DR-29*, DR 573 (CFMR, **holotype**; JBSD, **isotype**).

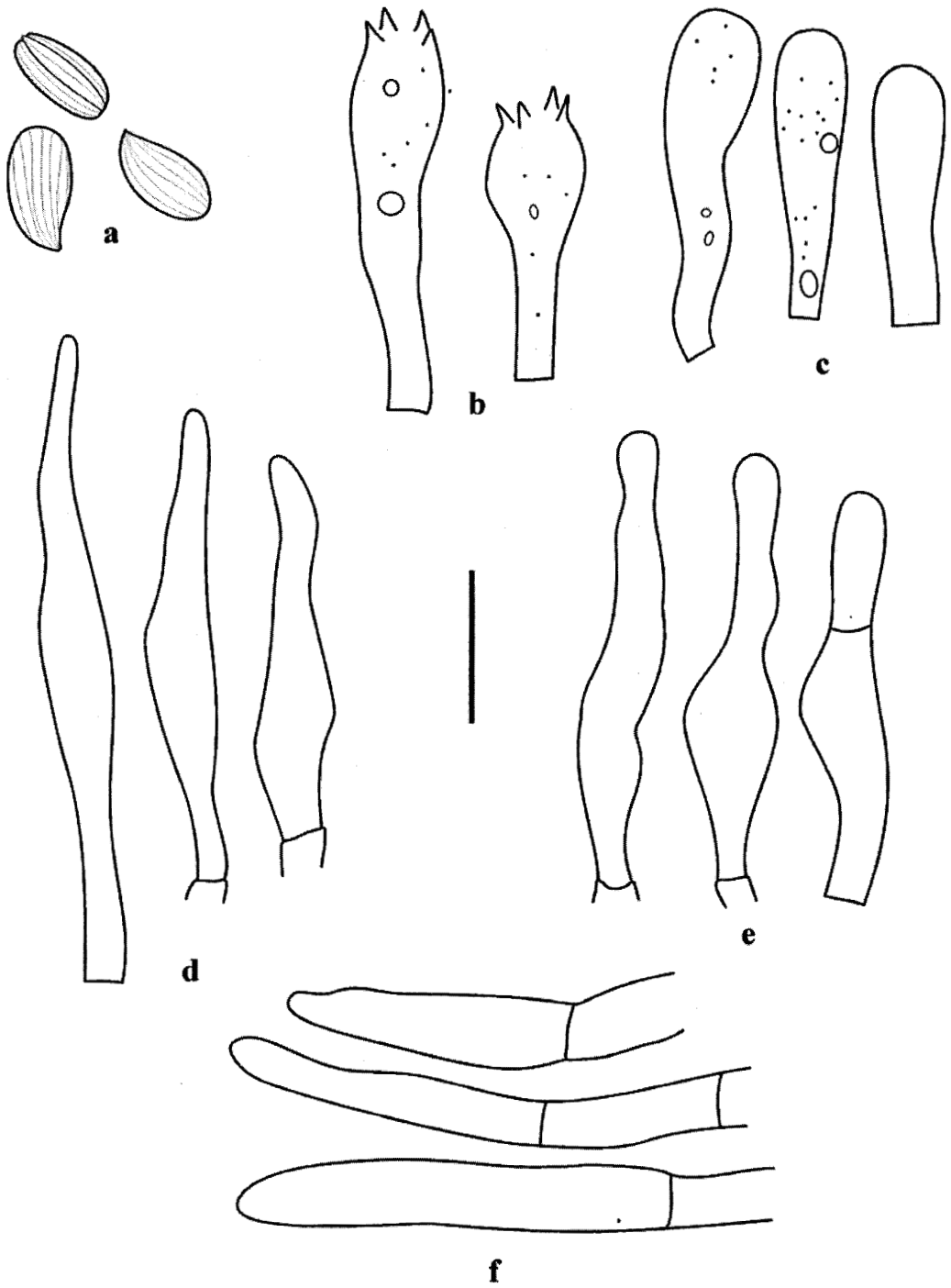


Fig. 13. *Boletellus domingensis*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** Caulocystidia; **f.** End-cells of pileipellis. *DJL-DR-29*. Scale bar = 20 μm.

Notes: *Boletus domingensis* is distinguished by the dark brown pileus surface, that is velutinous and becomes rimulose exposing a pale pink or buff context, a yellow hymenophore that bruises blue, a stipe context that becomes red upon exposure and spores that have fine longitudinal striations but lack transverse striae. This taxon belongs to Section *Chrysenteroidei*, with similarities to *B. chrysenteroides* and *B. fallax*. *Boletellus chrysenteroides* differs by the stipe context that bruises blue and the stipe surface that is dark brown or purple red near the base only and by its spores which are clearly winged both longitudinally and transversely. *Boletellus fallax* has a pileus surface that is appressed-fibrillose to fibrillose-scaly instead of velutinose to rimose, a stipe conspicuously scaly-shaggy instead of pruinose and the stipe context becomes blackish brown at the base instead of red to reddish brown. *Boletellus belizensis* has a paler brown pileus with reddish tints and its stipe context turns blue instead of red after exposed.

8. ***Boletellus singerii*** Gonz.-Velázq. & R. Valenz., *Mycotaxon* 55: 400 (1995). (Figs 14, 20)

Pileus 26-71 mm diam., convex, with a thick glutinous pellicle, rugose, appressed fibrillose under gluten; ground color white or Pale Pinkish Buff (5B3) with Brussels Brown to Cinnamon Drab (7D4) or grayish reddish-brown (8D4) fibrils, negative in KOH and NH_4OH; margin appendiculate, white. *Context* soft, glutinous, white, yellow above tubes, brown near stipe, not bruising, yellowish brown in KOH, negative in NH_4OH; 12 mm thick at center, 1-2 mm at margin. *Odor* not distinctive. *Taste* sweet. *Tubes* adnexed to free, depressed near stipe, 9-16 mm long, pale yellow or Olive Yellow (2C5) becoming greenish blue with time, yellowish brown in KOH, negative in NH_4OH; *pores* angular, 1-2/mm, concolorous with tubes, bruising Citrine (2E7-3D5). *Stipe* 130-147 mm long, 6-9 mm wide at apex, 10 mm at middle, 10-12 mm at base, equal to tapered at apex; glutinous, fibrillose under gluten, ground color white to pale grayish reddish-brown, yellow at base, with Cinnamon Drab (7D4) fibrils; negative in KOH and NH_4OH. *Context* hard, fibrous, white, not bruising; yellowish brown in KOH, negative in NH_4OH. *Basal mycelium* white, viscid. *Partial veil* cottony, white, glutinous, extending from pileus to stipe, not forming an annulus (at least not present when collected), but leaving remnants at the pileus margin. *Spore print* olive brown.

Basidiospores 11.2-18.4 × 7.2-9.6 µm (n = 20; 15.54 ± 1.57 × 8.4 ± 0.61; Q_m = 1.74 ± 0.20), ellipsoid, longitudinally winged, projecting up to 1.8 µm, lacking transverse striations, pale yellowish brown in KOH, some dextrinoid in Melzer's. *Basidia* 24-32 × 11.2-13.6 µm, clavate to obpyriform, (2-) 4-sterigmate. *Basidioles* 17.6-23.2 × 9.6-12 µm, obpyriform to clavate.

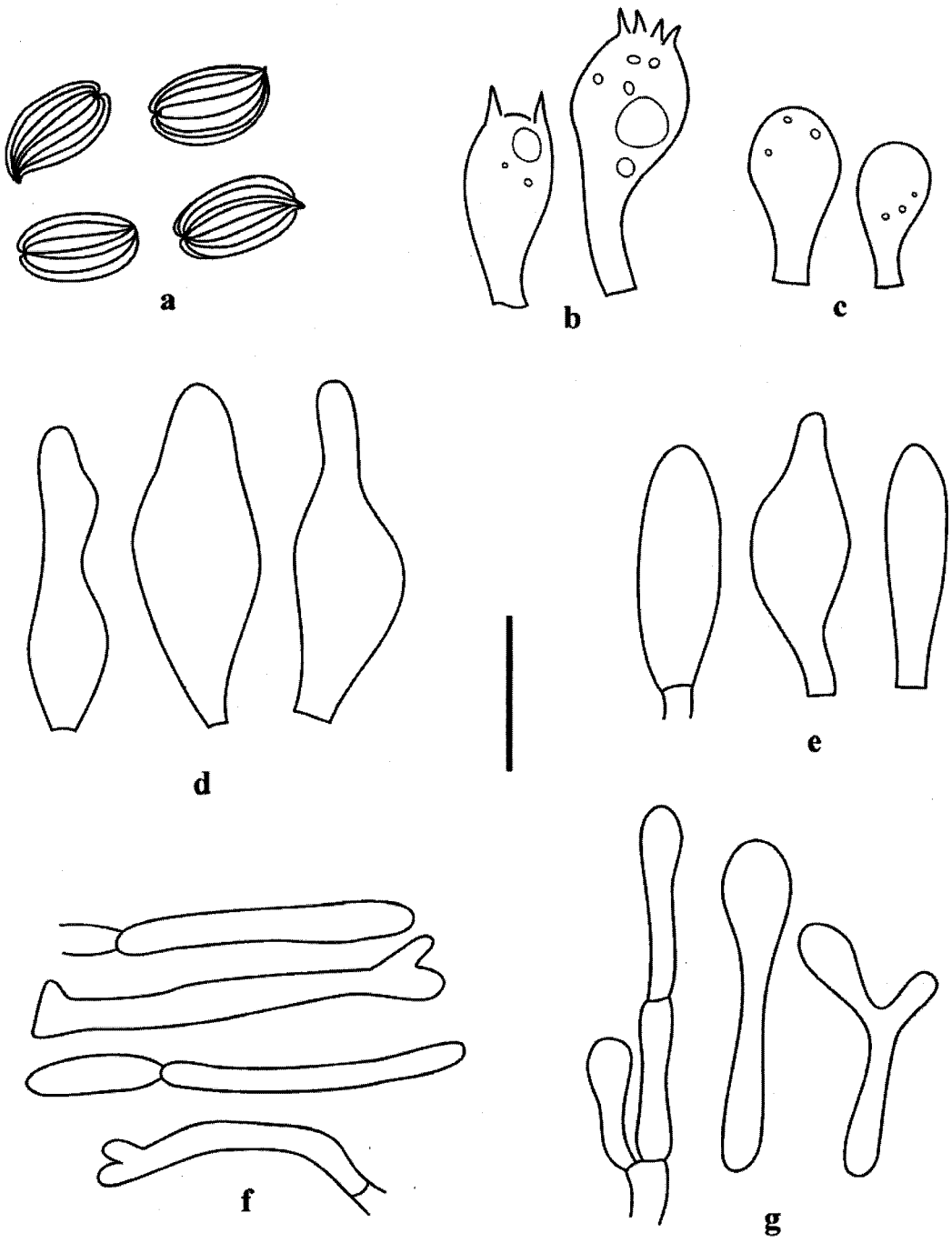


Fig. 14. *Boletellus singerii.* **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 468.* Scale bar = 20 µm.

Pleurocystidia 32.8-47.2 × 8.8-15.2 µm, subclavate, fusoid, ventricose. *Cheilocystidia* 20-36 × 9.6-12 µm, clavate, fusoid to obpyriform. *Pileipellis* an ixotrichodermium of hyphae 4-12 µm diam., hyaline in KOH, yellow in Melzer's; end cells cylindrical or irregularly shaped. *Stipitipellis* hyphae 5.2-13 µm diam., interwoven, subgelatinous, hyaline in KOH. *Caulocystidia* 16.8-41.6 × 4-8 µm, cylindrical to cylindric-clavate or irregularly shaped, usually in clusters; hyaline in KOH. *Veil hyphae* parallel or interwoven, septate, hyaline in KOH; end cells 3.9-11.7 µm diam., irregularly shaped.

Habitat: Gregarious under *Quercus* spp.

Known distribution: Mexico in North America; Belize in Central America.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve; near Cooma Cairn Station, intersection with Bradley Road, 17°N, 88°W, 900 m asl, 27 November 2002, *BOS 468,* BZ 2395 (BRH, CFMR).

Notes: This taxon is characterized by a brown to pale reddish-brown rugose pileus with a white margin, a glutinous basidiocarp and the presence of an appendiculate partial veil, leaving remnants on the pileus margin but not forming an annulus. It differs from the original description of *B. singerii* (González-Velázquez and Valenzuela, 1995) by the brown to grayish reddish-brown rather than yellow pileus and stipe colors, the rugose pileus surface, the absence of an annulus and its smaller pleurocystidia (32.8-47.2 × 8.8-15.2 µm vs. 58-64 × 18-24 µm).

Boletellus singerii belongs to Section *Ixocephali* and is related to *B. jalapensis* (Murrill) E.-J. Gilbert from Mexico, *B. elatus* Nagasawa from Japan and *B. longicollis* (Ces.) Pegler & T.W.K. Young from Malaysia. *Boletellus jalapensis* has a cinnamon brown pileus, a yellow margin and a non-glutinous stipe; *B. elatus* has a basidiocarp with sepia to chesnut brown rather than yellow colors, it has a non-glutinous pileus surface and it lacks a veil; *Boletus longicollis* has dark rufous brown colors and somewhat shorter basidiospores (9.5-15 µm vs. 8.8-19.2 µm).

Genus *Boletus* Dill. ex Fr.

9. ***Boletus aureissimus*** (Murrill) Murrill, Mycologia 30: 525 (1938).

(Figs 15, 21)

Synonyms:

Ceriomyces aureissimus Murrill, Mycologia 30: 522 (1938).

Boletus auripes var. *aureissimus* (Murrill) Singer, Mycologia 37: 797 (1945).

Pileus 32-109 mm diam., hemispheric to broadly convex or convex, smooth, dry; Spectrum Yellow (3A8) or Trogon Yellow (4A5); margin decurved forming a sterile band. *Context* soft, Sulfur Yellow (2A5) bruising Spectrum Yellow (3A8); 11-23 mm thick at center, 4-7 mm at margin. *Odor* bread-like.

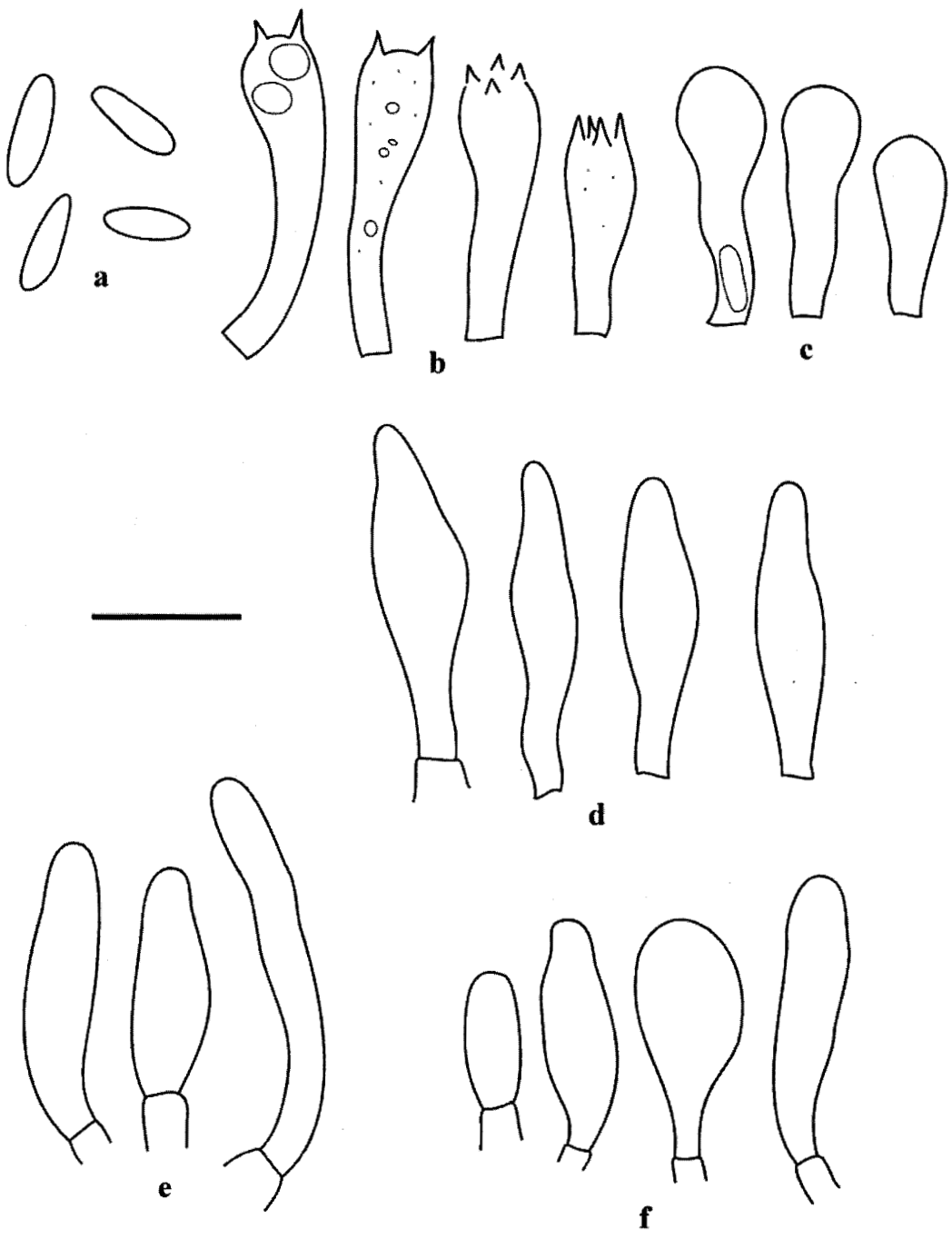


Fig. 15. *Boletus aureissimus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Pileocystidia; **f.** Caulocystidia. *BOS 353*. Scale bar = 20 µm.

Taste not distinctive to mild. *Tubes* adnate to adnexed, 5-7 mm long, Spectrum Yellow (3A8), not bruising; *pores* circular, 1-3/mm, initially stuffed and pale white then pale yellow to Olive Yellow (2C5), some becoming reddish brown with age, bruising Spectrum Yellow (3A8). *Stipe* 35-50 mm long, 12-15mm wide at apex, 15-25 mm at middle, 12-22 mm at base, equal, clavate or ventricose, finely to moderately reticulate at apex, smooth below, dry; ground color Sulfur Yellow (2A5) with paler reticulum, bruising Spectrum Yellow (3A8). *Context* soft, pale yellow bruising Spectrum Yellow (3A8). *Basal mycelium* pale yellow. KOH and NH_4OH negative in all parts. *Spore print* Sayal Brown (6D5).

Basidiospores 11.2-16 × 3.2-4.8 µm (n = 20; 13.4 ± 1.47 × 3.76 ± 0.53; Q_m = 3.60 ± 0.43), fusiform to cylindrical. *Basidia* 22.4-40.8 × 8.8-11.2 µm, clavate, (2-) 4-sterigmate. *Basidioles* 20-36 × 8.8-11.2 µm, clavate. *Pleurocystidia* 38.4-45.6 (-58.4) × 8-12.8 µm, fusoid-ventricose, fusoid-ampullaceous, few, scattered. *Cheilocystidia* not observed. *Pileipellis* a tangled layer of repent to suberect hyphae 4-14.4 µm diam., subgelatinous in some areas, hyaline in KOH; end cells 19.6-55.2 × 5.6-10.4 µm, cylindric, fusoid or clavate. *Stipitipellis* hyphae 3.2-11.2 µm diam., interwoven, gelatinous in some areas, hyaline or with grayish yellow contents in KOH. *Caulocystidia* 17.6-37.6 × 7.2-13.6 µm, cylindric or clavate.

Habitat: Solitary to gregarious under *Quercus oleoides* or *Quercus* spp. and *Pinus caribaea*.

Known distribution: North Carolina to Florida and west to Texas in North America; Belize in Central America (new record for Central America).

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 8 August 2002, *BOS 239*, BZ 1585 (BRH, CFMR); 14 August 2002, *BOS 272*., BZ 1617 (BRH, CFMR); 17 August 2002, *BOS 282*, BZ 1627 (BRH, CFMR); 7 October 2002, *TJB 9336*, BZ 2056 (BRH, CORT); 16 October 2003, *REH 8562*, BZ 3343 (BHR, NY); 12 October 2002, *BOS 353*, BZ 1702 (BRH, CFMR); 18 October 2002, *DJL-BZ-28*, BZ 1825 (BRH, CFMR); 22 October 2002, *BOS 393*, BZ 1742 (BRH, CFMR); 23 October 2002, *BOS 397*, BZ 1746 (BRH, CFMR); *BOS 398*, BZ 1747 (BRH, CFMR); 20 November 2002, *BOS 449*, BZ 2376 (BRH, CFMR); 12 October 2003, *BOS 608*, BZ 3161 (BRH, CFMR); 13 October 2003, *REH 8546*, BZ 3327 (BRH, NY, CFMR); 14 October 2003, *BOS 618*, BZ 3171 (BRH, CFMR); *TJB 9722*, BZ 3265 (BRH, CORT); *REH 8552*, BZ 3333 (BRH, NY); 15 October 2003, *TJB 9741*, BZ 3284 (BRH, CORT); 16 October 2003, *REH 8562*, BZ 3343 (BHR, NY).

Notes: *Boletus aureissimus* belongs to Section *Appendiculati* and it is distinguished by the yellow colors of the basidiocarp, the non-cyanescent context, the presence of a fine to moderate reticulum on the stipe apex and its good taste and edibility. It differs from *B. auripes* Peck of Section *Appendiculati* in having a yellow pileus instead of a brown one. Our collections agree with those described by Singer (1947).

10. ***Boletus auripes*** Peck, Ann. Rep. N. Y. State Museum 50: 107 (1898).
(Figs 16, 22)

Pileus 60-120 mm diam., convex or plano-convex, glabrous to finely matted, hard becoming soft, deep rust brown (6E7-8) with yellowish brown (5E7-8) or Clay Color (5D5) undertones becoming pale yellow with expansion (3-4A4-5), showing bright yellow (3A5) where pileipellis is missing; margin uplifted, with a very narrow sterile band (1-2 mm). *Context* bright yellow(3A5), not bruising blue. *Odor* mild. *Taste* not distinctive or fruity when cut. *Tubes* adnexed, 8-15 mm long, bright yellow (3A4); *pores* circular, 1/mm, initially stuffed, bright yellow becoming olivaceous with age. *Stipe* 30-80 mm long, 12-20 mm wide, sub-clavate or equal, strongly reticulate upper 2/3, pruinate or fibrillose below, bright yellow (3A5-6) with brown stains where handled. *Context* soft, bright yellow. *Basal mycelium* buff. *Spore print* not obtained. *Macro-chemical reactions* not obtained.

Basidiospores 9.6-12.8 × 3.2-4.8 µm (n = 20; 11.52 ± 1.26 × 4.12 ± 0.65; Q_m = 2.82 ± 0.2), fusiform to cylindrical, greenish yellow in KOH with bright greenish yellow or pale brown wall; yellow, orange brown or dextrinoid in Melzer's. *Basidia* 27.2-35.2 × 9.6-10.4 µm, clavate, 4-sterigmate. *Basidioles* 20-32.8 × 6.4-9.6 µm, clavate. *Hymenial cystidia* 36.8-41.6 × 5.6-8 µm, cylindrical, fusoid, fusoid-ampullaceous. *Pileipellis* an entangled trichodermium of erect hyphae 3.2-6.4 µm diam., hyaline or with grayish yellow contents in KOH; end cells 37.6-56 × 6.4-7.2 µm, cylindrical, clavate or fusoid, some with a subcapitate apex, some moderately thick-walled. *Stipitipellis* hyphae 3.2-9.6 µm diam., interwoven, hyaline in KOH. *Caulocystidia* 24-75.2 × 6.4-12 µm, numerous, versiform, mostly cylindrical tapering at apex, fusoid, fusoid ventricose or fusoid-ampullaceous.

Habitat: Gregarious under *Quercus peduncularis* or *Quercus* spp.

Known distribution: Eastern Canada to Florida, west to New York, south to Mexico in North America; Belize in Central America.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Macal River, Guacamayo Bridge at the oak stand above river, 16°53'16.2"N, 89°2'22.2"W, 594 m asl, 5 October 2002, *TJB 9321*, BZ 2041 (BRH, CORT, CFMR); 14 October 2002, *BOS 359*, BZ 1708 (BRH, CFMR); 20 October 2002, *BOS 387*, BZ 1736 (BRH, CFMR).

Notes: *Boletus auripes* is distinguished by the yellowish brown to chestnut-brown pileus surface that becomes paler with age, a yellow context that does not stain blue and a reticulate stipe. *Boletus aureissimus* is very similar but it has a deep to pale yellow pileus. Our collections of *B. auripes* agree with those described by Singer (1947), but they have somewhat smaller basidiospores (9.6-12.8 × 3.2-4.8 µm vs. 11-14.9 × 3.9-5.2 µm) than the Holotype (Baroni, 1998).

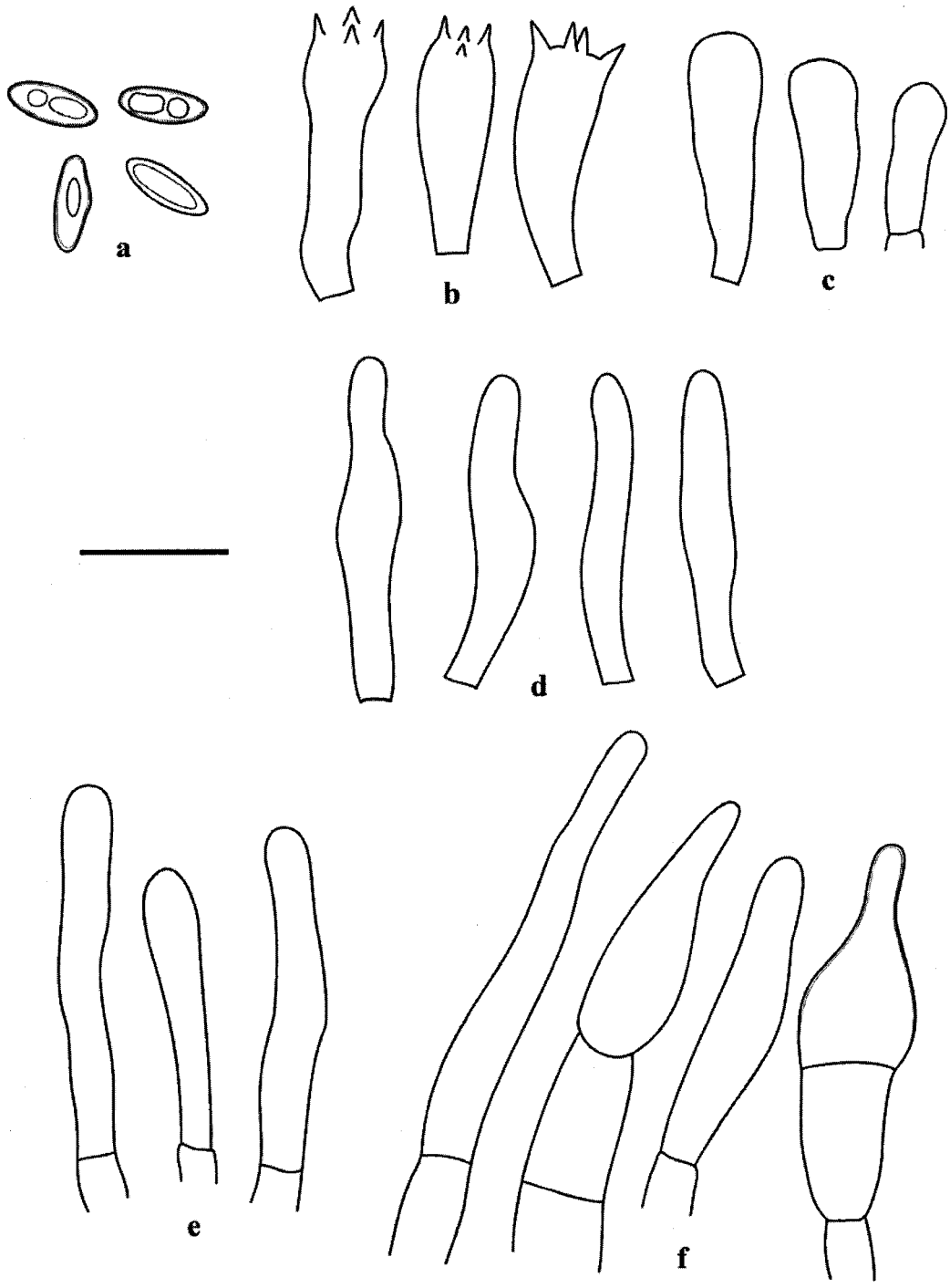


Fig. 16. *Boletus auripes*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** End-cells of pileipellis; **f.** Caulocystidia. *TJB 9321*. Scale bar = 20 µm.

11. ***Boletus* cf. *auriporus*** Peck, Ann. Rep. N. Y. State Cabinet 23: 133 (1873). (Figs 17, 23)

Synonyms:
Boletus aurisporus (sic!) Frost, Bull. Buffalo Soc. Nat. Sci. 2: 103 (1874).
Suillus auriporus (Peck) Kuntze, Rev. Gen. Pl. 3: 595 (1898).
Ceriomyces auriporus (Peck) Murrill, Mycologia 1: 147 (1909).
Xerocomus auriporus (Peck) Singer, Rev. de Mycol. 5: 6 (1940).
Pulveroboletus auriporus (Peck) Singer, Amer. Midl. Nat. 37: 13 (1947).
Aureoboletus auriporus (Peck) Pouzar, Cesk. Mykol. 11: 49 (1957).

Pileus 40-73 mm diam., convex to plano-convex, felty, slightly viscid when wet; ground color Cinnamon Drab (7D4) or Cinnamon Brown (5D5-6) to pale vinaceous brown with Walnut Brown (8E5) hairs, negative or becoming paler or becoming slowly bright orange in KOH, pinkish red becoming slowly bright orange in NH_4OH; margin decurved with a small sterile band. *Context* soft, white, not bruising but becoming slowly pale yellow-green, negative in KOH and NH_4OH; (3-) 5-10 mm thick at center, (1.5-) 2-3 mm at margin. *Odor* not distinctive to slightly bread-like. *Taste* sweet to slightly sour. *Tubes* sinuate with decurrent tooth, depressed to deeply depressed around stipe, 5-10 mm long, vivid yellow becoming pale Olive Yellow (2C5), bruising slightly greenish blue, pale brown in KOH, brownish green in NH_4OH; *pores* radially elongated, 1-2/mm, vivid yellow to bright Olive Yellow (2C5), bruising greenish blue. *Stipe* 53-65 mm long, 5-7 mm wide at apex, 6-9 mm at middle, 9-11 mm at base, tapered at apex, clavate, finely pruinose at apex or overall, fibrillose below, finely longitudinally striate, covered with fine yellow floccules at apex or overall; ground color Chamois (4A4) at apex, Cinnamon (5C4) below with Mahogany Red (8D6) to Brick Red (8-9E8) fibrils; negative in KOH and NH_4OH. *Context* soft, white with a pale brown tint at base, not bruising, negative in KOH and NH_4OH; wormhole color reddish brown. *Basal mycelium* white. *Spore print* Straw Yellow (3B4) to Olive Yellow (2C5). $FeSO_4$ negative in all parts.

Basidiospores 12.8-16 × 4.8-6.4 µm (n = 20; 14.48 ± 1.19 × 5.24 ± 0.48; Q_m = 2.78 ± 0.33), fusiform, subcylindrical, greenish yellow to greenish yellow-brown in KOH, dextrinoid in Melzer's. *Basidia* 24-29.6 × 8-10.4 µm, clavate, 4-sterigmate. *Basidioles* 14.4-29.6 × 7.2-8 µm, clavate. *Pleurocystidia* 37.6-68 × 5.6-13.6 µm, fusoid-ventricose, fusoid-ampullaceous, cylindrical or sub-lageniform. *Cheilocystidia* 21.6-40 × 6.4-8 µm, cylindric-fusoid, cylindric-clavate, subfusiform. *Pileipellis* an entangled trichodermium of erect hyphae 4-12.8 µm diam., branched, hyaline in KOH, dextrinoid in Melzer's; end cells mostly cylindrical, short to elongated. *Stipitipellis* hyphae 3.2-12 µm diam., interwoven, subparallel, multi-septate, subgelatinous in some areas, plicate or encrusted in others, hyaline or with pale grayish yellow contents in KOH.

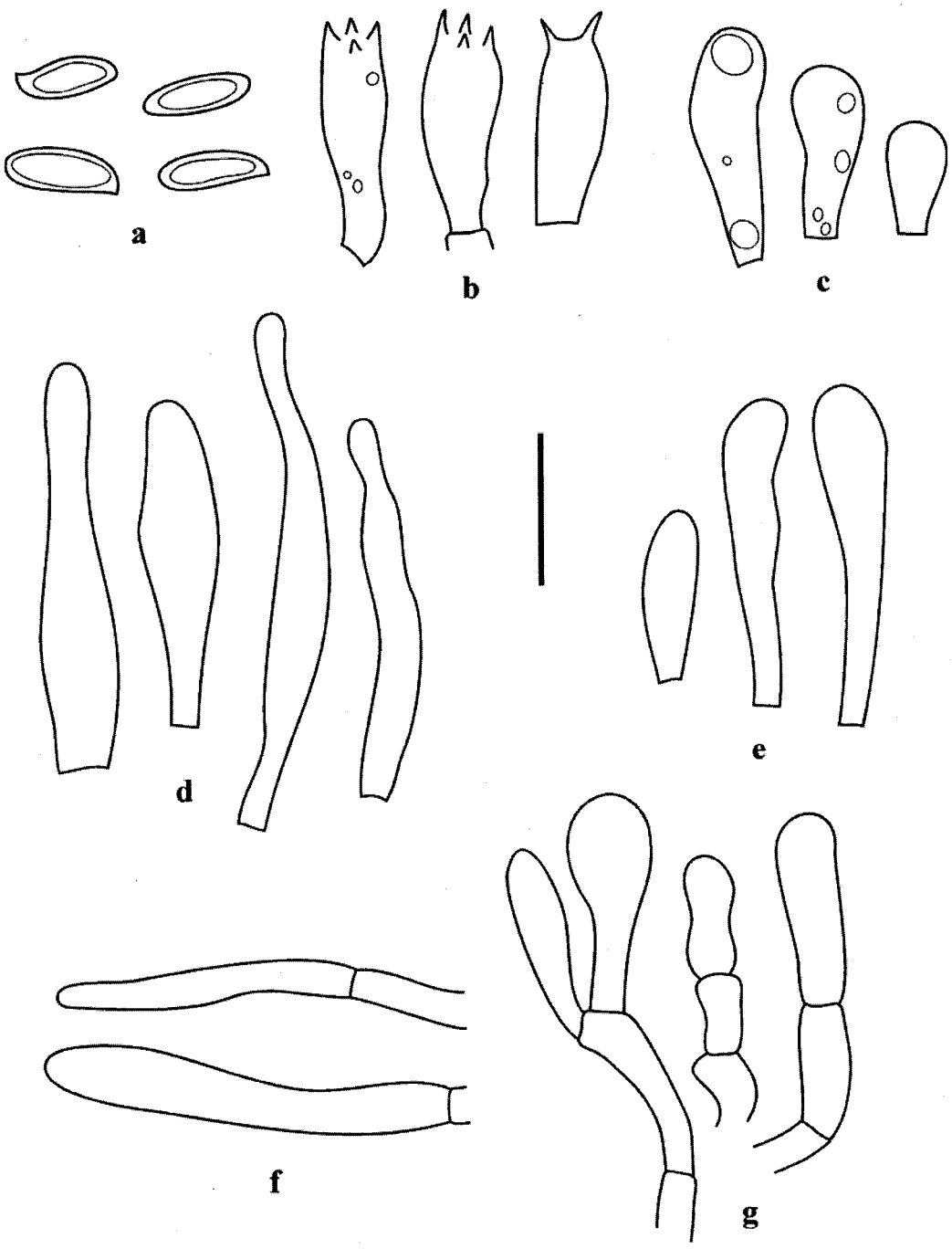


Fig. 17. *Boletus* cf. *auriporus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 374*. Scale bar = 20 µm.

Caulocystidia 16-43.2 × 4.8-18.4 µm, subcylindrical, clavate, broadly clavate or obpyriform.

Habitat: Solitary to gregarious under *Quercus oleoides* or *Quercus* spp. and *Pinus caribaea*.

Known distribution: *Boletus auriporus* has been reported from New Jersey to Florida, west to Mississippi, Texas and Mexico in North America; Costa Rica in Central America.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 18 October 2002, *BOS 374*, BZ 1723 (BRH, CFMR); 12 October 2003, *BOS 601*, BZ 3155 (BRH, CFMR).

Notes: *Boletus auriporus* is distinguished by the golden yellow hymenophore that becomes olive yellow at maturity and the yellow floccosity over the stipe surface, characteristics that differentiate it from *B. atkinsonianus* (Murrill) Sacc. & Trotter of Section *Cartilaginei* and *B. innixus* Frost of Section *Auripori*. Our collections are similar to those described by Singer (1947) and Both (1998), but differ in several characteristics: the basidiocarp is not very viscid when wet, the pileus context is white instead of yellowish cream; our collections lack the pinkish vinaceous color of the stipecontext and the cystidia are most frequently fusoid-ampullaceous, sublageniform or subfusiform rather than clavate as described for *B. auriporus*.

In addition, although our collections have yellow floccules over the stipe, the colors of the basidiocarp, especially the hymenophore, are not as bright as in the species described from Costa Rica and North America.

12. ***Boletus brunneopanoides*** B. Ortiz, **sp. nov.** (Figs 18, 24)

MycoBank: 511047

Etymology: *brunneo* - brown; *panoides* - appearance (and odor) of a round loaf of brown bread.

Pileus super discum nitidus, ad marginem velutinus, brunneus. *Contextus* flavidus, caerulescens demum cinerascens. *Tubi* et pori caerulescens, tubi flavi, subdecurrentes, *pori* brunnei vel rubrobrunnei. *Stipes* ad basim accuminatus, rubrobrunneus, ubi contusi fuscans, intus albidus, ad apicem caerulescens.

Pileus 120-160 mm diam., convex, felty and shiny at center, velvety to margin, slightly viscid when wet; Mars Brown (7F8), Verona Brown (6E7) and Sayal Brown (6D5) from center to margin, not bruising, reddish brown in KOH, negative in NH_4OH; worm hole color pale yellow or pale red; margin decurved. *Context* pale yellow with some red areas, bruising blue then becoming gray, pale yellow in KOH, negative in NH_4OH; 20-26 mm thick at center, 7-15 mm at margin. *Odor* of bread yeast. *Taste* sweet. *Tubes* adnexed, with long decurrent tooth, shallowly depressed near stipe, 10 mm long, yellow, bruising blue, reddish brown in KOH, negative in NH_4OH; *pores* angular, 2/mm, brown or reddish brown, bruising Indigo Blue (19F7). *Stipe* 65-72 mm long, 17-32

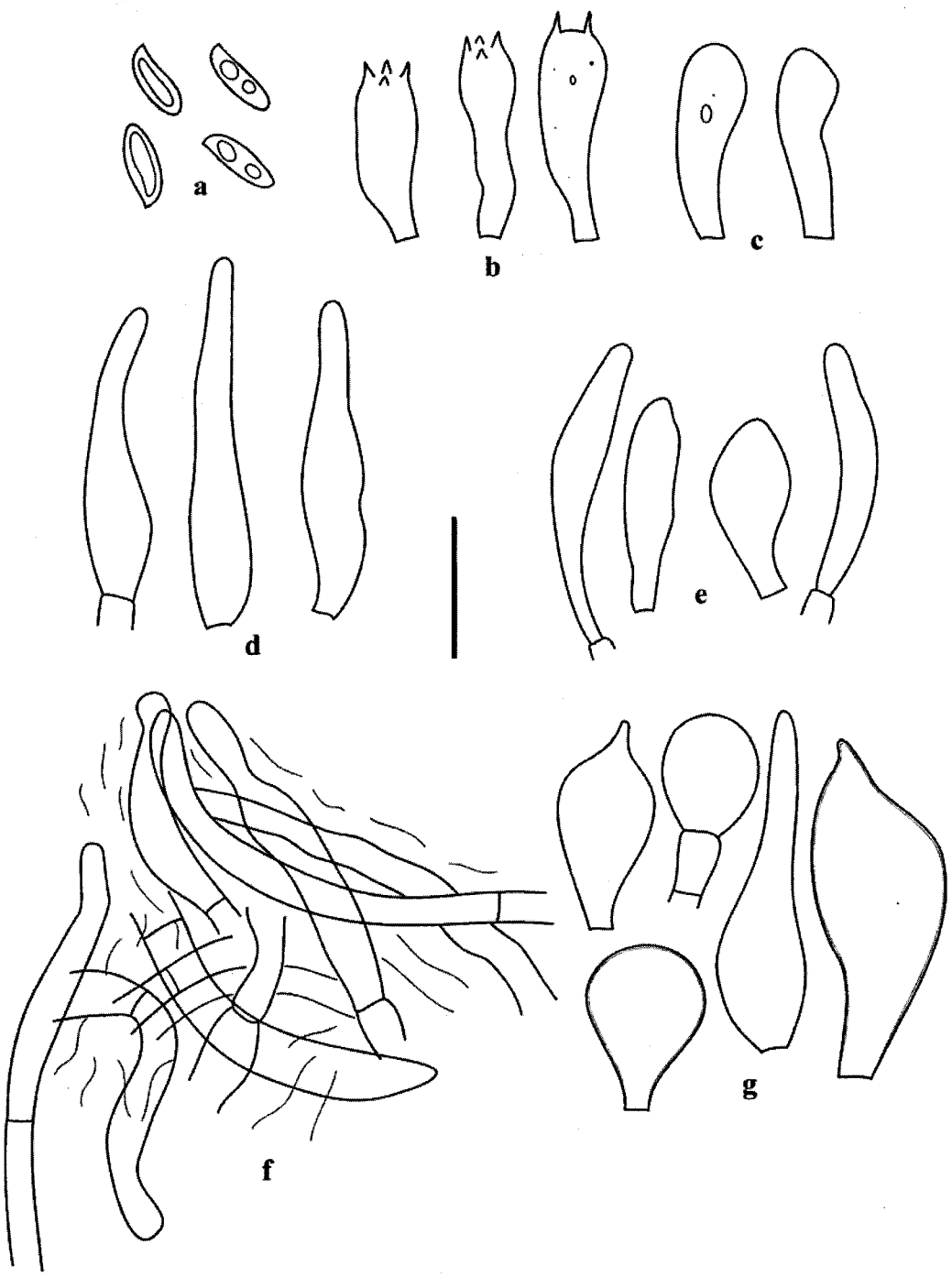


Fig. 18. *Boletus brunneopanoides*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Pileipellis; **g.** Caulocystidia. *BOS 389*. Scale bar = 20 μm.

mm wide at apex, 17-24 mm at middle, 15-20 mm at base, equal, tapered at base; sublamellate at apex, fibrillose below, pruinose at base; ground color Pale Horn Color (4B3), becoming reddish brown, with Light Drab (5D3), Dark Drab (5E4) or Hair Brown (5F5) pruina and fibrils, darkening after bruising; orange brown in KOH, yellowish brown in NH_4OH. *Context* fibrous, white with some Light Drab (5D3) areas, bruising blue at apex and Drab (5D4) near base, negative in KOH and NH_4OH. *Basal mycelium* whitish cream, in some areas yellowish brown. $FeSO_4$ negative in all parts. *Spore print* not obtained.

Basidiospores 8.8-12.8 × 4 µm (n = 20; 11.16 ± 1.28 × 4; Q_m = 2.79 ± 0.32), fusiform, smooth, greenish yellow or yellowish brown with darker wall in KOH, dextrinoid in Melzer's. *Basidia* 22.4-32 × 8-8.8 µm, clavate, 2 or 4-sterigmate. *Basidioles* 24-27.2 × 8-8.8 µm, clavate. *Pleurocystidia* 39.2-56 × 8-9.6 µm, fusoid-ampullaceous, lageniform, hyaline or with golden yellow contents in KOH and Melzer's. *Cheilocystidia* 22.4-43.2 × 4.8-11.2 µm, fusoid, subcylindrical, sublanceolate. *Pileipellis* a tangled layer of repent or suberect hyphae 2.4-13.6 µm diam., subgelatinous, encrusting pigments yellowish brown, grayish brown or reddish brown in H_2O, diffusing with the application of KOH, producing yellowish brown or orange brown to golden orange-yellow color reactions; hyaline or with grayish yellow or grayish yellowish brown contents in KOH; dextrinoid in Melzer's; end cells cylindrical, some with acute apex. *Stipitipellis* hyphae 3.2-15.2 µm diam, parallel, in some areas subgelatinous, cellular in others because of clusters of caulocystidia, some slightly thick-walled; hyaline or grayish yellow in KOH, yellow in Melzer's.*Caulocystidia* 16-47.2 × 4-18.4 µm, versiform, mostly obpyriform,clavate-mucronate, fusoid ventricose or cylindrical, slightly to moderately thick-walled, concolorous with hyphae.

Habitat: Caespitose on soil near *Pinus caribaea*.

Distribution: Belize.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Five Sisters Lodge, resort grounds, 17°2'16.2"N, 88°59'8"W, 380 m asl, 21 October 2002, *BOS 389*, BZ 1738 (CFMR **holotype**; BRH, **isotype**).

Notes: *Boletus brunneopanoides* is distinguished by the brown colors of the basidiocarp, blue bruising reaction of the hymenophore and context, yellow tubes and brown to reddish brown pores, a pale yellow or nearly white context and a pruinose stipe. The color of the pores places it in Section *Luridi* near the *Boletus vermiculosus* group. *Boletus vermiculosus* sensu Smith & Thiers (1971) has more dull red tones over the pileus, tubes more greenish yellow, circular pores that become paler with time, stipe with more yellow tones staining black where handled, thin-walled caulocystidia filled with yellow pigments and somewhat longer basidiospores (10-13.5 vs. 8.8-12.8 µm). *Boletus subgraveolens* A.H. Sm. & Thiers has a yellow brown pileus and dominant

yellow hues in the stipe and pores, the pileus surface becomes areolate, the stipe has red stains near the base, it has a strong disagreeable odor of urine, the cystidia are more fusoid ventricose and the caulocystidia are thin-walled. *Boletus vermiculosoides* A.H. Sm. & Thiers has a yellow to brown rather than pinkish brown pileus and stipe, its cystidia are fusoid ventricose and some have yellowish brown contents.

13. ***Boletus brunneotomentosus*** B. Ortiz, **sp. nov.** (Figs 25, 30-31)
MycoBank: 511048

Etymology: *brunneo* - brown; *tomentosus* - tomentum; for the brown tomentum on the lower portion of the stipe.

Pileus late convexus vel convexus, coactus, brunneus. *Contextus* pallide flavus, fractu lutescens. *Tubi* flavi, subdecurrentes, ubi contusi olivaceo-flavi, pori concolores. *Stipes* pallide flavus, striatus, rubro-pruinosus, tomentosus ad basim, intus albidus.

Pileus 25-89 mm diam., broadly convex to convex, felty, slightly viscid when wet, Warm Sepia (7F5-6) to Prout's Brown (7F4), dark brown in KOH; margin decurved. *Context* soft, watery, pale yellow, bruising Spectrum Yellow (3A8), yellowish brown in KOH. *Odor* bread-like. *Taste* sweet, slightly sour. *Tubes* adnate with long decurrent tooth, 2-10 mm long, yellow to Olive Yellow (2C5), bruising bright olive yellow, yellowish brown in KOH; *pores* radially elongated, 0.5-1.5 × 0.5-1 mm, concolorous with tubes. *Stipe* up to 70 mm long, 8-20 mm wide at apex, 13-18 mm at middle, 12-18 mm at base, subequal; pruinose, finely longitudinally striate, with a yellowish brown tomentum from base to the midsection; ground color pale yellow, with Crimson (10C8) to Brick Red (8-9E8) pruina. *Context* fibrous, white, bruising pale grayish vinaceous, becoming olive yellow or olive-blue in some areas, negative in KOH. *Basal mycelium* white. *Spore print* pale brownish olive.

Basidiospores 10.4-13.6 × 4-4.8 µm (n = 20; 12.44 ± 1.12 × 4.6 ± 0.36; Q_m = 2.72 ± 0.30), subfusiform, smooth, greenish yellow with brown wall in KOH, dextrinoid in Melzer's. *Basidia* 23.2-28 × 8.8 µm, clavate, (2-) 4-sterigmate. *Basidioles* 19.2-28 × 7.2-9.6 µm, clavate. *Pleurocystidia* 32.8-64 × 7.6-8.8 µm, fusoid-ampullaceous, sublageniform, some subcapitate. *Cheilocystidia* 37.6-38.2 × 8-8.8 µm, fusoid-ventricose to fusoid-ampullaceous. *Pileipellis* hyphae cellular, sphaerocysts like cells of 16.8-32 × 16.8-25.6 µm, subgelatinous, encrusting pigments yellowish brown to brown in H_2O, diffusing with the application of KOH producing a pale orange brown or yellowish brown color reaction; hyaline or with grayish yellow or pale grayish orange brown contents in KOH; pale yellow in Melzer's. *Stipitipellis* hyphae 4.8-28 µm diam., interwoven, subgelatinous, grayish yellow in KOH, pale yellow in Melzer's. *Caulocystidia* 28-57.6 × 4-9.6 µm, clavate, fusoid, fusoid-mucronate, hyphoid; contents grayish yellow to yellowish brown in KOH,

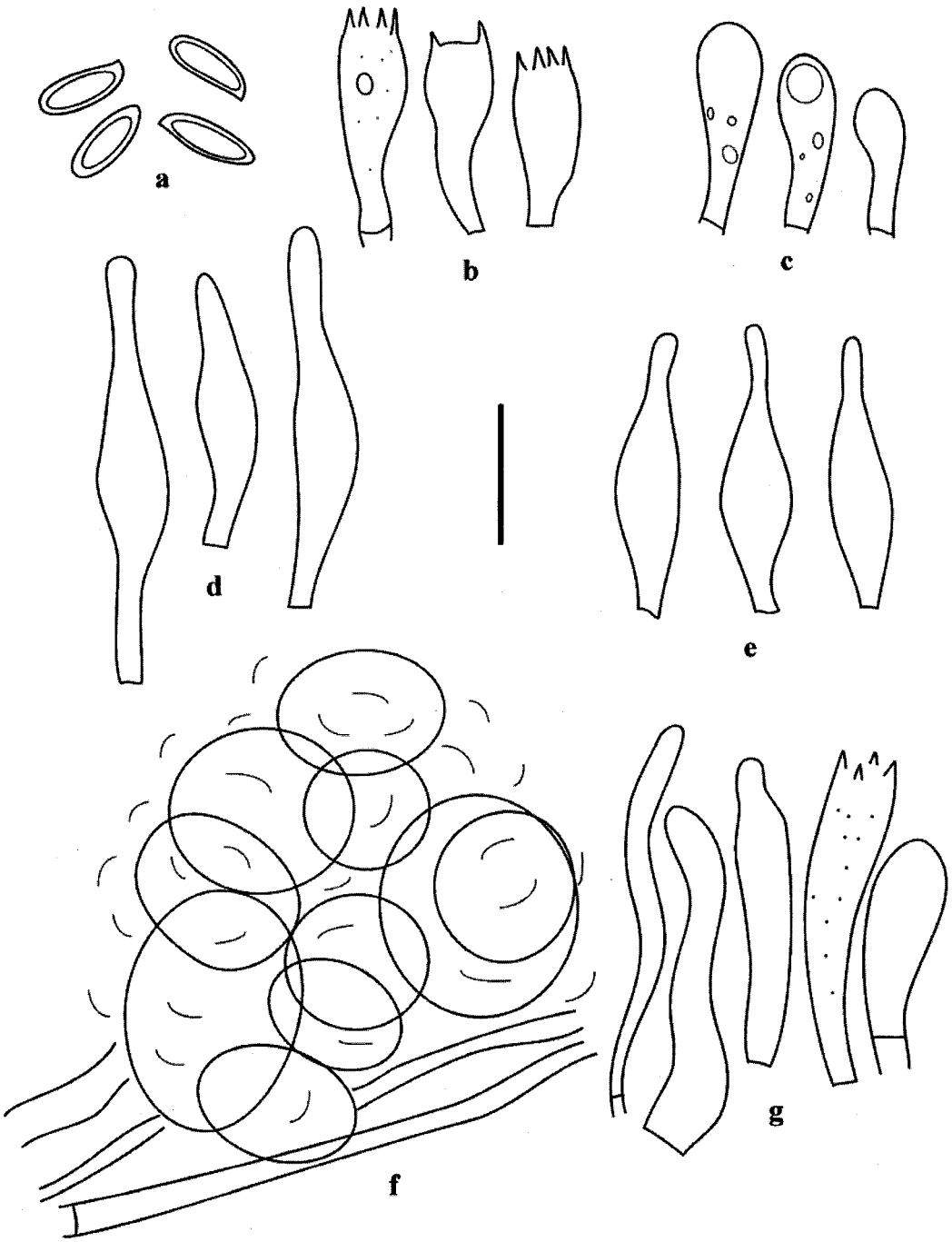


Fig. 25. *Boletus brunneotomentosus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Pileipellis; **g.** Caulocystidia and dermatobasidium. *BOS 485*. Scale bar = 20 µm.

yellow or orange brown in Melzer's; *dermatobasidia* 44-44.8 × 8.8-10.4 µm, 4-sterigmate, grayish yellow in KOH, orange brown in Melzer's.

Habitat: Caespitose or gregarious under *Quercus* spp.

Known distribution: Belize.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Five Sisters Lodge, near fork in entrance road to Lodge, 17°2'20.2"N, 88°58'16.2"W, 432 m asl, 15 October 2002, *TJB 9404*, BZ 2124 (BRH, CFMR); near Cooma Cairn Station, intersection with Bradley Road, 17°N, 88°W, 900 m asl, 30 November 2002, *BOS 482,* BZ 2410 (BRH, CFMR); Douglas da Silva, near Forestry Station cabins, 16°58'23"N, 89°59'39"W, 450 m asl, 1 December 2002, *BOS 485,* BZ 2413 (CFMR, **holotype**; BRH, **isotype**).

Notes: *Boletus brunneotomentosus* is distinguished by the Warm Sepia to Prout's Brown pileus, a stipe with Crimson to Brick Red pruina, a white basal mycelium, a yellowish brown tomentum from base to stipe midsection, an olive-yellow hymenophore and yellow context that do not stain blue and the presence of sphaerocysts in the pileipellis. It belongs to Section *Subpruinosi* with similarities to the *Boletus rubellus* Krombh. complex. *Boletus rubellus* ssp. *dumetorum* Singer is the closest taxon, but this species has a Brick Red rather than dark reddish brown pileus, its hymenophore usually stains blue or green when touched, the basal mycelium is yellow or Sulphur Yellow instead of white, its basidia are larger (31-34 × 10-13.5 µm vs. 23.2-28 × 8.8 µm) and it lacks sphaerocysts in the pileipellis. *Boletus brunneotomentosus* is also similar to *Boletus orquidianus* Halling (1989) in the color and surface texture of the pileus, the spores size and the presence of sphaerocyst-like cells in the pileipellis, but *B. orquidianus* has a white context, its stipe is not pruinose and lacks the yellowish brown tomentum, it does not have hymenial cystidia and it grows associated with hardwoods other than *Fagaceae.*

14. ***Boletus* cf. *caribaeus*** (Singer) Singer, Sydowia 30: 254 (1977).

(Figs 26, 32)

Synonym:

Boletus rubellus ssp. *caribaeus* Singer, Mycologia 37: 798 (1945).

Pileus 62-76 mm diam., plane, moderately indented, felty, tomentose in some areas, not viscid, greenish brown (5-E-F5) to dark brown (7-F6), bruising reddish brown, reddish brown in KOH and NH_4OH; margin uplifted, slightly incurved. *Context* soft, moist, yellow, bruising blue, orange yellow in KOH, negative in NH_4OH; 8-12 mm thick at center, 2-3 mm at margin. *Odor* mild, bread-like. *Taste* slightly sour. *Tubes* adnexed, shallowly depressed near stipe, 6-10 mm long, pastel yellow or dull yellow, bruising dark blue, orange yellow to brownish orange in KOH, negative in NH_4OH; *pores* circular to angular, mustard, yellow brown or reddish brown, bruising dark blue. *Stipe* 47-72 mm long, 17-18 mm wide at apex and middle, 12-13 mm at base, equal with tapered base; pruinose with a tomentum extending from the base to the midsection, of

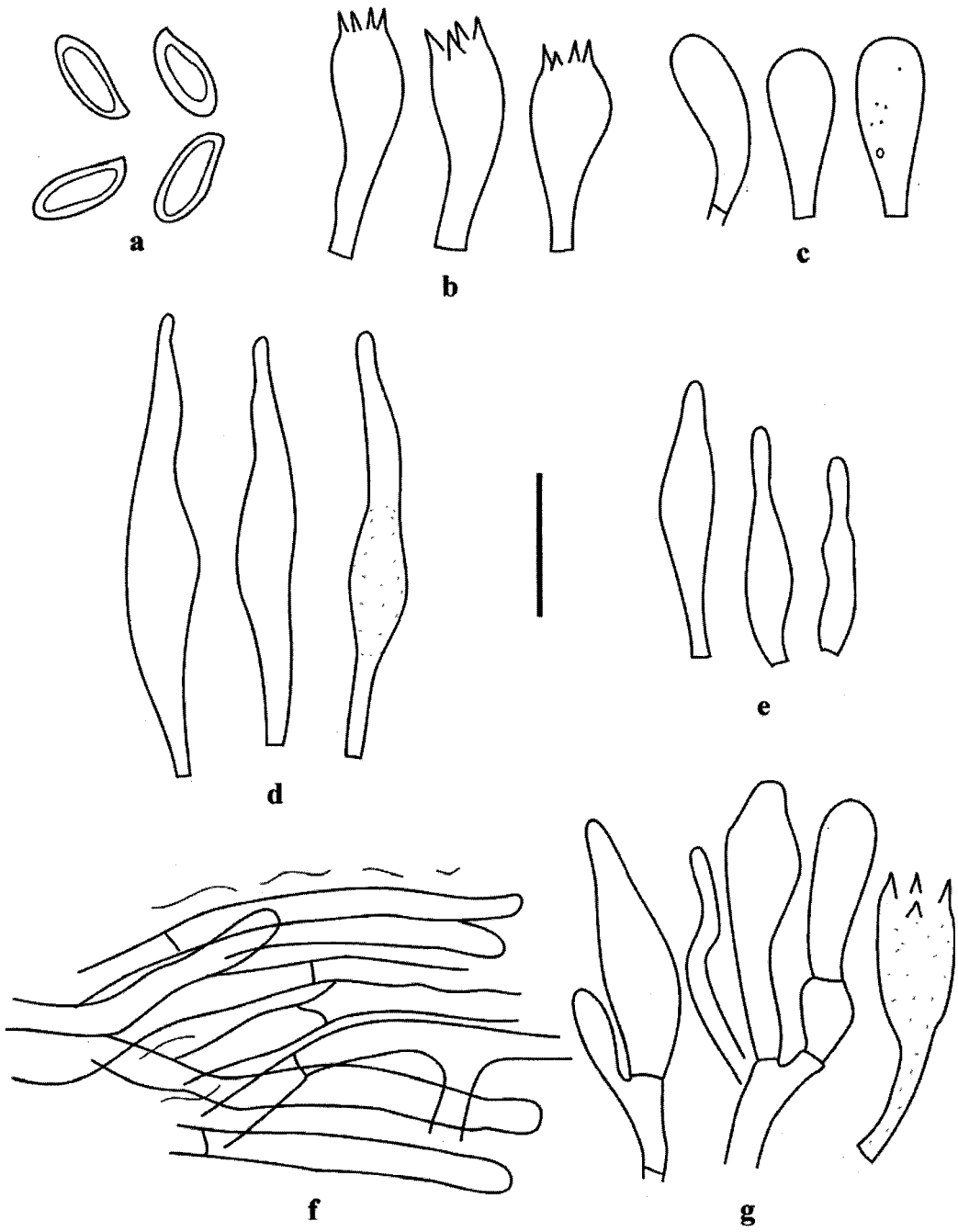


Fig. 26. *Boletus* cf. *caribaeus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Pileipellis; **g.** Caulocystidia. *BOS 600*. Scale bar = 20 µm.

greenish brown or yellowish brown tones; ground color yellow near apex, pale pink below with deep red or brownish red pruina, bruising dark reddish brown; slightly yellow in KOH, negative in NH_4OH. *Context* hard in base, dark yellow becoming reddish brown, mainly in the center, bruising blue, negative in KOH and NH_4OH. *Basal mycelium* grayish yellow. *Spore print* greenish brown (on pileus surface).

Basidiospores 12-14.4 × 4.8-5.6 µm (n = 20; 13.24 ± 0.8 × 5.28 ± 0.4; Q_m = 2.51 ± 0.15), subfusiform, smooth, greenish golden yellow in KOH with dark brown wall, dextrinoid in Melzer's. *Basidia* 26.4-30.4 × 8.8-9.6 µm, clavate, 4-sterigmate, with long sterigmata. *Basidioles* 22.4-24.8 × 7.2-8.8 µm, clavate. *Pleurocystidia* 56-64 × 7.2-9.6 µm, fusoid-ampullaceous, fusoid-ventricose, some melleous; contents golden yellow in KOH, orange brown in Melzer's.

Cheilocystidia 25.6-46.4 × 4-7.2 µm, fusoid, fusoid-ampullaceous, fusoid-ventricose. *Pileipellis* a tangled layer of repent hyphae 3.2-9.6 µm diam., subgelatinous, encrusting pigments yellow, yellowish brown or reddish brown in H_2O, diffusing very fast with the application of KOH, producing a bright orange yellow color reaction; contents yellow, grayish yellow or yellowish brown in KOH, yellowish orange, orange or dextrinoid in Melzer's; end cells cylindrical. *Stipitipellis* hyphae 3.2-12.8 µm diam., interwoven, pale grayish yellow in KOH, yellowish in Melzer's. *Caulocystidia* 21.6-47.2 × 8-15.2 µm, versiform, clavate, ventricose, cylindric-clavate, hyphoid, yellowish brown in KOH, dextrinoid in Melzer's; *dermatobasidia* 36.8-41.6 × 11.2-12.8 µm, 4-sterigmate, yellowish brown in KOH, orange brown to dextrinoid in Melzer's.

Habitat: Gregarious under *Pinus caribaea* and *Quercus spp.*

Known distribution: Belize.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at the Tropical Education Center, 17°21'27"N, 88°32'30"W, 23 m asl, 18 October 2002, *BOS 373* BZ 1722 (BRH, CFMR); 12 October 2002, *TJB 9379*, BZ 2099 (BRH, CORT); 12 October 2003, *BOS 600* , BZ 3154 (BRH, CFMR).

Notes: *Boletus caribaeus* has a Brick Red to terra cotta to olive brown pileus, a yellow to amber hymenophore, a yellow context bruising strongly blue and a finely pruinose stipe with yellow ground and deep red tint at base. It belongs to Section *Luridi*, close to *Boletus rubricitrinus* (Murrill) Murrill and its relatives. *Boletus rubricitrinus* (according to Singer's description, 1947) has red tones over the pileus, its stipe is longitudinally striate or rugulose, the basal mycelium is white to pale ochraceous or salmon ochraceous instead of yellowish brown and it has larger basidiospores (12.5-18.8 × 4.5-7.7 µm vs. 9-14.5 × 4-6.5 µm). The pileus of *Boletus oliveisporus* (Murrill) Murrill is fulvous to cinnamon brown, bruising blue; it has a reddish brown zone beneath the pileipellis, a yellow stipe that becomes olive brown and a white basal

mycelium. *Boletus brunneotomentosus*, described above, differs in having an olive yellow rather than amber hymenophore, a context that does not stain blue, and presence of sphaerocysts in the pileipellis. Our taxon differs from Singer *et al.*'s (1983) description of *B. caribaeus* in having a grayish yellow basal mycelium instead of white, a yellowish brown tomentum from base to the stipe's midsection, the pores become reddish brown and it has longer cheilocystidia (25.6-46.4 µm vs. 20-23 µm).

15. ***Boletus dupainii*** Boud., Bulletin de la Société de Mycologique de France, XVIII, p. 139 (1902). (Figs 27, 33)

Pileus (34-) 41-86 (-130) mm diam., hemispherical to broadly convex then convex, smooth, very viscid when wet, shiny, Carmine (11D8), Geranium (10B8) or Crimson (10C8) bruising blackish blue, greenish brown to bronze in KOH, negative in NH_4OH, brown in $FeSO_4$; worm hole color Chamois (4A4) or Ferrugineous (8C-D6-7); margin decurved. *Context* pale yellow bruising blue, bronze in KOH, greenish blue in NH_4OH; 11-17 mm thick at center, 4-6 mm at margin. *Odor* not distinctive. *Taste* sour. *Tubes* adnate to adnexed, adnate with a tooth or shallowly depressed around stipe, 1.5-7 mm long, pale yellow, bruising blue, bronze in KOH, greenish blue in NH_4OH; *pores* circular or nearly circular, 3/mm, Spectrum Red (10C8), bruising Indigo Blue (19F8). *Stipe* 50-97 long, 12-21 mm wide at apex, 18-20 mm at middle, 10-20 mm at base, equal or slightly ventricose, pruinose; ground color Sulfur Yellow (2A5) or white with orange red or Brick Red (8-9E8) pruina overall, bruising dark blue; yellowish brown in KOH, greenish blue in NH_4OH. *Context* soft, fibrous, hard to base, Sulfur Yellow (2A5) becoming Brick Red (8-9E8) with age, bruising blue. *Basal mycelium* pale yellow. *Spore print* brownish olive.

Basidiospores 12.8-14.4 × 4-5.6 µm (n = 20; 12.95 ± 0.81 × 4.4 ± 0.55; Q_m = 2.99 ± 0.42), fusiform, yellowish brown in KOH. *Basidia* 24-29.6 × 9.6-10.4 µm, clavate, 4-sterigmate. *Basidioles* 16-32 × 5.6-8.8 µm, clavate. *Pleurocystidia* 26.4-47.2 × 7.2-8.8 µm, fusoid, fusoid-ventricose, fusoid-ampullaceous. *Cheilocystidia* 16-30.4 × 4.8-8 µm, fusoid-ventricose, fusoid-mucronate, clavate. *Pileipellis* a loosely ixotrichodermium of hyphae 2.4-5.6µm diam., consisting of long thin filaments embedded in a gelatinous layer, hyaline or with yellowish brown contents in KOH, some areas dextrinoid in Melzer's; end cells cylindrical. *Stipitipellis* hyphae 3.2-5.6 µm diam., interwoven, hyaline in KOH. *Caulocystidia* 16-36.8 × 5.6-11.2 µm, abundant, versiform, clavate to fusoid-ventricose, hyaline or with yellow or dark golden yellow contents in KOH.

Habitat: Gregarious on sandy soil under *Quercus peduncularis* or *Quercus* spp.

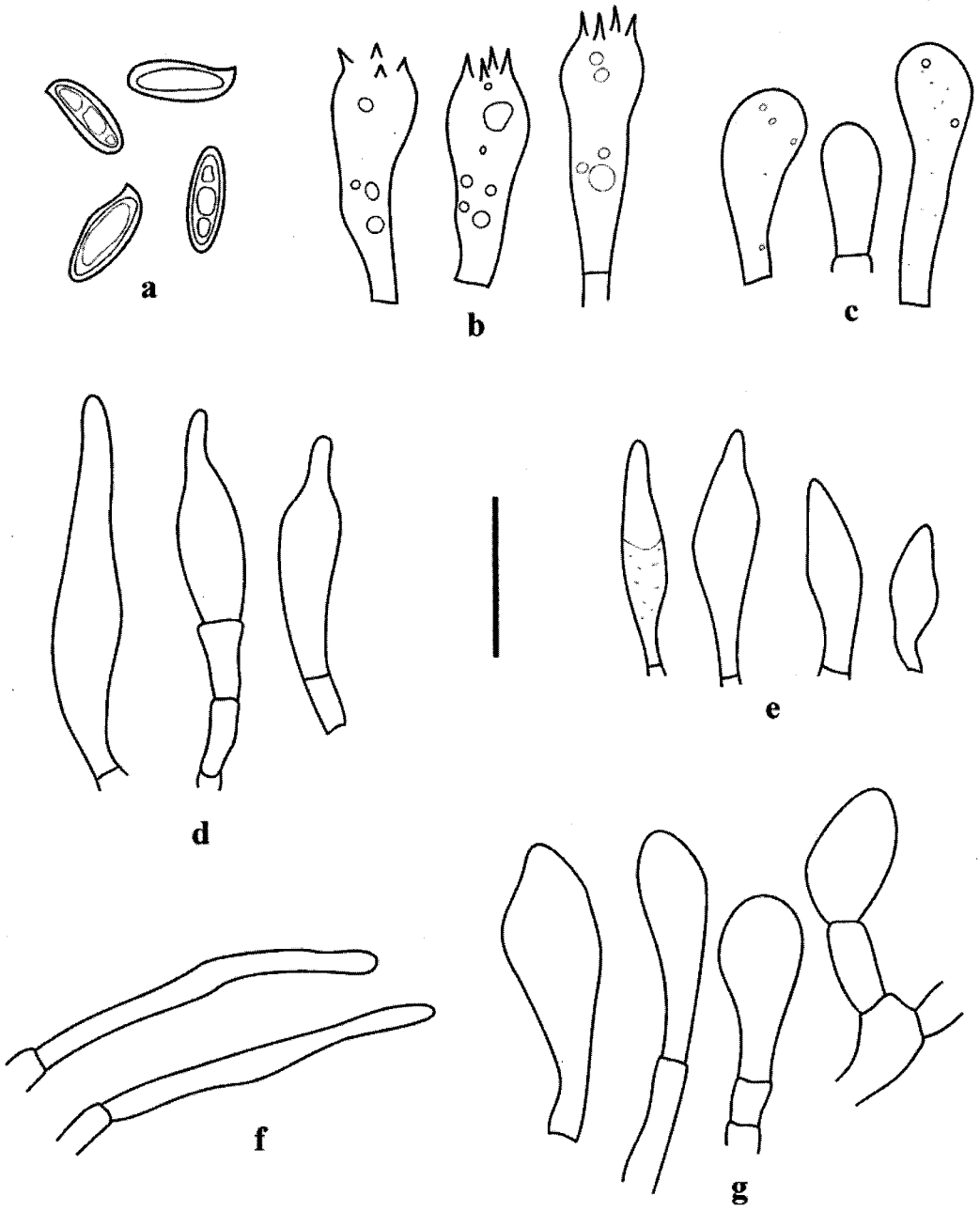


Fig. 27. *Boletus dupainii*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 465*. Scale bar = 20 μm.

Known distribution: Europe; North Carolina in North America; Belize in Central America. These collections represent the second report of *B. dupainii* in the Western Hemisphere.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Macal River, Guacamayo Bridge at the oak stand above river, 16°53'16.2"N, 89°2'22.2"W, 594 m asl, 26 November 2002, *BOS 465*, BZ 2392 (BRH, CFMR); Five Sister Lodge, lower Nature Trail, 17°2'16"N, 88°59'8"W, 308 m asl, 9 August 2001, *TJB 9132*, BZ 320 (CORT, CMFR); 27 November 2002, *BOS 469*, BZ 2396 (BRH, CMFR); 30 November 2002, *CLO 4302*, BZ 2449 (BRH, CMFR); same loc., near fork in entrance road to Lodge, 17°2'20.2"N, 88°58'16.2"W, 432 m asl, 15 October 2002, *BOS 365*, BZ 1714 (BRH, CMFR); 28 November 2002, *BOS 473*, BZ 2401 (BRH, CMFR).

Notes: *Boletus dupainii* can be distinguished by the intense bright red color over the basidiocarp, a viscid and shiny pileus surface and a pruinose stipe. In terms of the pileus color and surface texture this species is similar to *B. frostii* Russell, but the latter has a strongly alveolate-reticulate stipe. It also appears to be closest to *Boletus flammans* E.A. Dick & Snell, which differs from *B. dupainii* in the surface of the stipe, which is reticulate at least in the upper half, the habitat (with conifers rather than oak) and smaller basidiospores (10-13 × 3.5-5 µm vs. 10-18 × 3.3-6.5 µm). Our collections agree with those described by McConnell and Both (2002) from North Carolina, although the basal mycelium is pale yellow instead of white.

16. ***Boletus firmus*** Frost, Bull. Buffalo Soc. Nat. Sci. 2: 103 (1874).

(Figs 28, 34)

Pileus 58-104 mm diam., broadly convex to plane, finely velvety, not or slightly viscid when wet; pale Cream Color (4A3) to pale Tawny Olive (5C4), Pale Pinkish Buff (5B3) or Pale Horn Color (4B3), some gray with pink hues; bruising Raw Umber (5E5-6) or dark brown, pale grayish vinaceous or brown in KOH, negative in NH_4OH, gray in $FeSO_4$; margin decurved to recurved. *Context* solid, soft, pale yellow, bruising blue then becoming cream or sordid grayish white diffused with blue, orange brown in KOH, negative in NH_4OH and $FeSO_4$. *Odor* fruity. *Taste* very bitter. *Tubes* adnate to adnexed, with decurrent tooth, 6-10 mm long, yellowish green, bruising greenish blue, yellowish brown in KOH and NH_4OH, negative in $FeSO_4$; *pores* angular, 2/mm, Cinnamon Rufous (7C-D7) to Ferrugineous (8C-D6-7) to Red, bruising Indigo Blue (19F8). *Stipe* 42-75 mm long, 14-19 mm wide at apex, 12-18 mm at middle, 11-22 mm at base, subequal with tapered base, finely pruinose at apex, fibrillose below; some finely reticulate at apex, with the reticulum yellow or obscure; ground color yellow at apex, cream below, with Drab (5D4) to Dark Drab (5E4) fibrils; yellowish brown in KOH and NH_4OH, dark blue in $FeSO_4$. *Context* fibrous, pale yellow to Cream Color (4A3), Sayal Brown (6D5) to base, some with a red tint at base, bruising blue, yellowish brown in KOH, negative

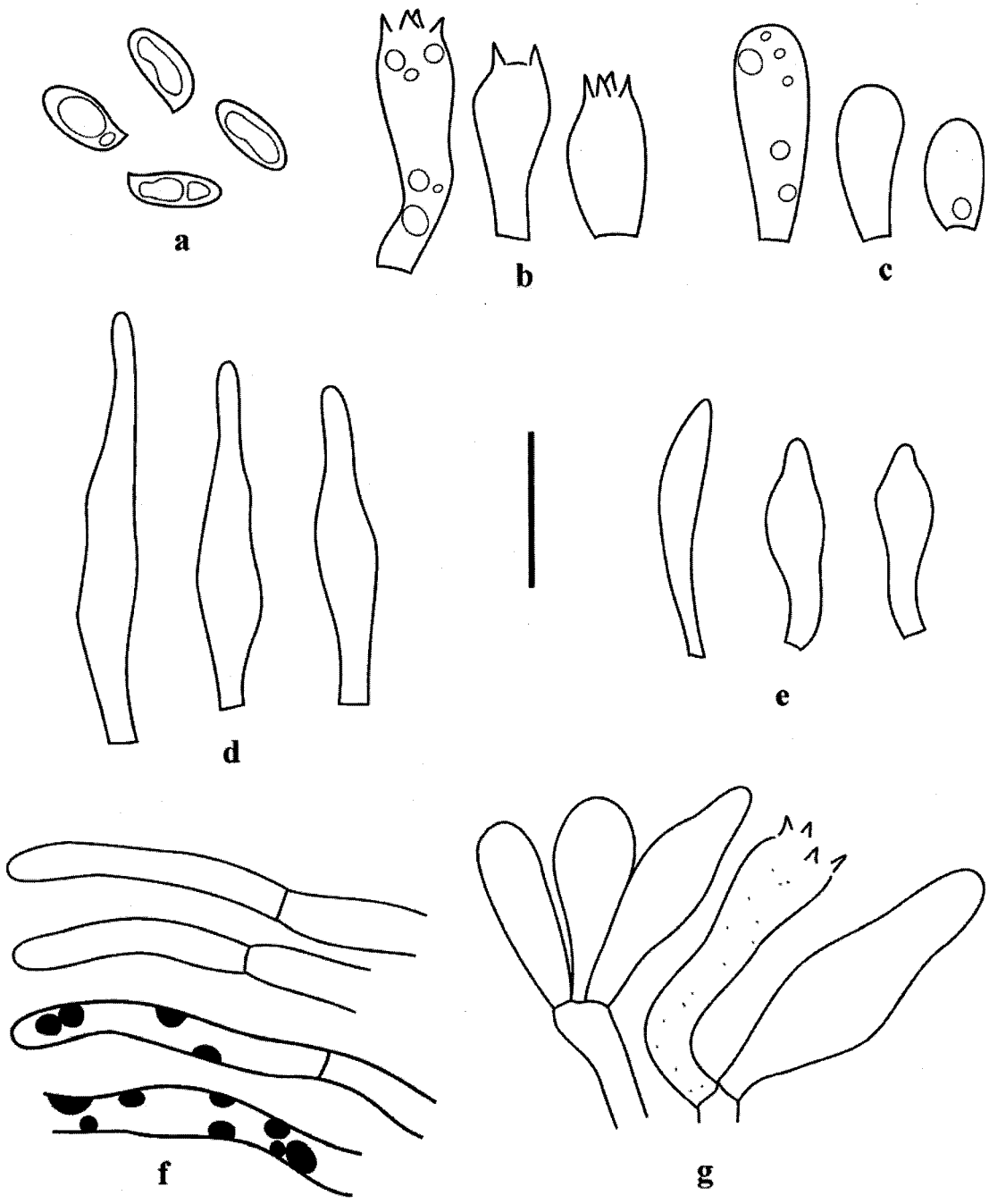


Fig. 28. *Boletus firmus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Pileipellis; **g.** Caulocystidia and dermatobasidium. *BOS 372*. Scale bar = 20 µm.

in NH_4OH, grayish blue in $FeSO_4$. *Basal mycelium* white, creamy cinereous, buff, Drab Gray or yellowish brown. *Spore print* Citrine (2E7-3D5).

Basidiospores (8.8-) 10.4-12.8 × 4.8-5.6 µm (n = 20; 10.78 ± 1.19 × 4.38 ± 0.91; Q_m = 2.29 ± 0.22), ellipsoid to fusoid, greenish yellow with brown wall in KOH. *Basidia* 18.4-30.4 × 9.6 µm, clavate, (2-) 4-sterigmate. *Basidioles* 13.6-28 × 7.2-9.6 µm, clavate. *Pleurocystidia* 40-54.4 × 7.2-8 µm, fusoid-ampullaceous, cylindric-fusoid. *Cheilocystidia* 24-36 × 5.6-8 µm, fusoid, fusoid-ventricose, ventricose-rostrate. *Pileipellis* a tangled layer of repent to suberect hyphae 3.2-8.1 µm diam., contents and encrusted pigments bright yellow or yellowish brown in KOH; with masses of amyloid inclusions within the hyphae in Melzer's, inclusions of 1.4-3.6 µm diam.; end cells cylindrical. *Stipitipellis* hyphae 2.4-10.4 µm diam., hyaline in KOH. *Caulocystidia* 14.4-41.6 × 7.2-12 µm, clavate, cylindrical, fusoid-ventricose, hyaline or with grayish yellow to golden yellow contents in KOH; *dermatobasidia* present.

Habitat: Solitary under *Quercus oleoides*, *Q. peduncularis* and *Pinus caribaea*.

Known distribution: Eastern North America from Canada to Georgia, and west to Mississippi; Belize and Costa Rica in Central America.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 18 October 2002, *BOS 372,* BZ 1721 (BRH, CFMR). Cayo District: Mountain Pine Ridge Forest Reserve, Five Sisters Lodge, near fork in entrance road to Lodge, 17°2'20.2"N, 88°58'16.2"W, 432 m asl, 15 October 2002, *TJB 9403*, BZ 2123 (BRH, CORT, CFMR).

Notes: *Boletus firmus* is distinguished by the pallid colors of the basidiocarp contrasting with the red pores and usually a red reticulum, the bluing context and hymenophore, its bitter taste and the presence of amyloid inclusions in the pileipellis hyphae. *Boletus piedmontesis* Grand & A.H. Sm. and *Boletus satanas* var. *americanus* Coker & Beers are considered synonyms of this species. Our collections differ from those described by Halling and Mueller (1999) in that the yellow reticulum is confined to the apex, the greater abundance of cystidia, larger pleurocystidia (40-54.4 × 7.2-8 µm vs. 20-30 × 5-7 µm), the presence of dermatobasidia on the stipitipellis and somewhat wider basidiospores (4.8-5.6 µm vs. 4.2-4.9 µm). It differs somewhat in having a yellow reticulum that is confined to the stipe apex but the reticulum in *B. firmus* is extremely variable based on examination of extensive collections by one of the authors (EEB).

17. ***Boletus floridanus*** (Singer) Singer, Sydowia 30: 255 (1977).

(Figs 29, 35)

Synonym:
Boletus frostii ssp. *floridanus* Singer, Mycologia 37: 799 (1945).

Pileus 40-116 mm diam., broadly convex to convex, slightly depressed at center, felty, occasionally pruinose at center, slightly viscid when wet; Hazel (8E5) or pale Maroon (10F8), bruising Chesnut (10E6) or Maroon (10F8), dark brown in KOH, darkening in NH_4OH; margin decurved, forming a sterile band. *Context* solid, pale yellow, bruising blue, bright yellow in KOH, negative in NH_4OH; 9-16 mm thick at center, 3-6 mm at margin. *Odor* sweet, fruity. *Taste* sweet. *Tubes* adnate to sinuate, 5-9 mm long, Sulphur Yellow (3B5), bruising Plumbeous (20F3) to Indigo (20F5), orange brown in KOH, brown in NH_4OH; *pores* circular, 2-3/mm, Brick Red (8-9E8), bruising Indigo Blue (19F8). *Stipe* 50-70 mm long, 9-17 mm wide at apex, 12-20 mm at middle, 8-16 mm at base, equal or slightly ventricose; moderately reticulate in upper 2/3, tomentose to base; ground color yellow at apex, Spinel Red (11A7) below with a Brick Red (8-9E8) reticulum and a Rose Pink (11A4) tomentum, reddish brown in KOH, brown in NH_4OH. *Context* fibrous, pale yellow bruising blue at apex, becoming pale Spinel Red (11A7) in some areas, yellowish brown in KOH, brown in NH_4OH. *Basal mycelium* pale yellow. *Spore print* color greenish brown.

Basidiospores 12.8-16 × 4-5.6 µm ($n = 20$; $14.6 \pm 1.0 \times 4.96 \pm 0.67$; $Q_m = 2.99 \pm 0.44$), fusiform, greenish yellow with brown wall in KOH, some dextrinoid in Melzer's. *Basidia* 25.6-35.2 × 10.4 µm, clavate, (2-) 4-sterigmate. *Basidioles* 12-25.6 × 5.6-9.6 µm, clavate. *Pleurocystidia* 33.6-45.6 × 6.4-11 µm, fusoid-ventricose, fusoid-ampullaceous, some lageniform. *Cheilocystidia* 28-54.4 × 7.2-12 µm, fusoid, fusoid-ventricose, fusoid-ampullaceous, some with golden yellow encrusted pigments in KOH. *Pileipellis* a loosely tangled layer of repent hyphae 3.2-11.2 µm diam., embedded in a gelatinous layer; contents and encrusted pigments golden yellow in KOH, dextrinoid in Melzer's; end cells cylindrical or irregularly shaped. *Stipitipellis* hyphae 2.4-9.6 µm diam., long interwoven hyphae, collapsed in some areas, contents grayish yellow or golden yellow in KOH. *Caulocystidia* 16-64 × 4-8 µm, fusoid, cylindrical or clavate, with grayish yellow or golden yellow contents in KOH, dextrinoid in Melzer's.

Habitat: Gregarious under *Quercus peduncularis* or *Quercus* spp. and *Coccoloba belizensis*.

Known distribution: Tennessee, North Carolina to Florida, west to Texas and south to Mexico in North America; Belize in Central America (first report for Central America).

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Macal River, Guacamayo Bridge at the oak stand above river, 16°53'16.2"N, 89°2'22.2"W, 594 m asl, 5 October 2002, *BOS 326*, BZ 1675 (BRH, CFMR); *TJB 9330*, BZ 2050 (BRH, CORT); *PR 153* (BRH); 20 October 2002, *BOS 383*, BZ 1732 (BRH, CFMR); 4 October 2003, *REH 8518*, BZ 3299 (BRH, NY).

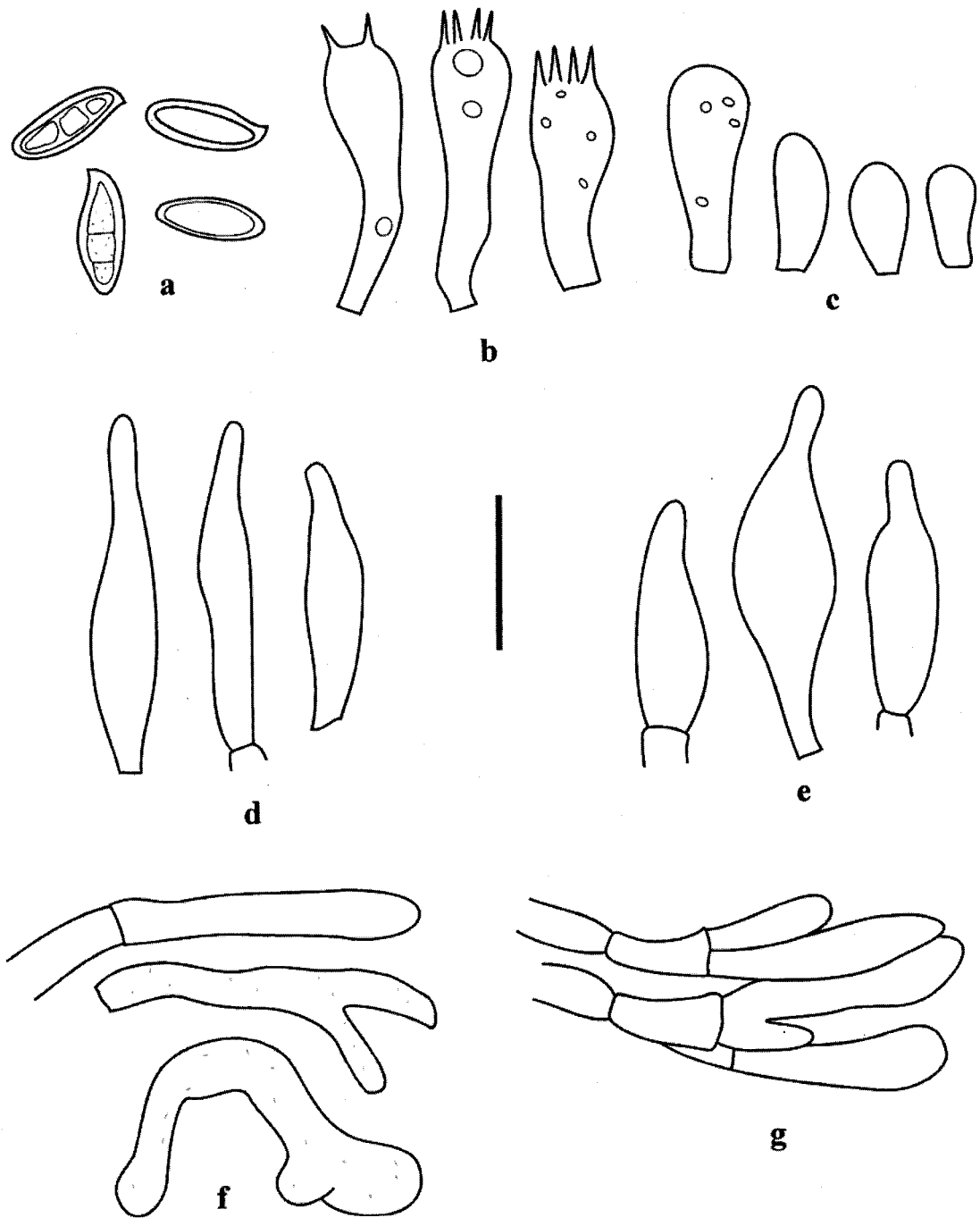


Fig. 29. *Boletus floridanus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 326*. Scale bar = 20 µm.

Notes: *Boletus floridanus* is characterized by the grayish red to intense red colors on the pileus and stipe with yellow tubes, red pores, its reticulate stipe and the strong bluing reactions of context and hymenophore. Our collections agree with those described by Singer (1945b).

18. ***Boletus guatemalensis*** R. Flores & Simonini, Rivista di Micologia 2: 139 (2000). (Figs 36, 41)

Pileus 51-54 mm diam., convex, felty, rimose areolate, dry; Flesh Color (7B3), Vinaceous (11B5) or Mahogany Red (8D6), exposed areas pale Sulphur Yellow (3B5), becoming in some areas Brussels Brown, negative in KOH, dark brown in NH_4OH, dark brown to black in $FeSO_4$; margin plane, with a Brick Red (8-9E8) sterile band. *Context* pale yellow, unchanging after bruised, negative or slightly pink in KOH, negative or gray in NH_4OH; 10 mm thick at center, 5 mm at margin. *Odor* not determined. *Taste* sour. *Tubes* adnexed, depressed around stipe or free, with long decurrent tooth, 6-13 mm long, yellow, not bluing, orange brown in KOH, negative or gray in NH_4OH, gray in $FeSO_4$; *pores* radially elongated, 1-2 × 0.5-1 mm, Brick Red (8-9E8), not bluing. *Stipe* 47 (-75) mm long, (9-) 11 mm wide at apex and middle, 7 (-8) mm at base, tapered at base; pruinose, moderately viscid; ground color Straw Yellow (3B4), with Spinel Pink (11A7) to reddish pink pruina, pruina becoming Dark Drab (5E4) to Sepia (5A1-2); fibrils turning brown in KOH, negative in NH_4OH. *Context* slightly viscid, pale yellow, unchanging after bruised. *Basal mycelium* white. *Spore print* Dark Drab (5E4).

Basidiospores (8.8-) 9.6-11.2 × 4.8-5.6 (-6.4) µm (n = 20; 10.13 ± 0.75 × 4.94 ± 0.48; Q_m = 2.09 ± 0.04), ellipsoid, greenish yellow to bright lemon yellow with darker wall in KOH. *Basidia* 30.4-37.6 × 9.6-12 µm, clavate, (2-) 4-sterigmate. *Basidioles* 20-36.8 × 6.4-12 µm, clavate. *Pleurocystidia* 44.8-68.8 × 8-12 µm, few, cylindric-fusoid, fusoid-ampullaceous, some thick-walled. *Cheilocystidia* 22.4-53.6 × 5.6-8 µm, fusoid, cylindric-fusoid, cylindric-clavate, mostly thick-walled (0.5-1 µm thick). *Pileipellis* a tangled layer of elongated repent hyphae 3.2-11.2 µm diam., hyaline or with grayish yellow, golden yellow or yellowish brown contents in KOH; end cells cylindrical. *Stipitipellis* hyphae 2.4-11.2 µm diam., parallel to interwoven, hyaline, some with golden yellow contents in KOH. *Caulocystidia* 16.8-39.2 × 4.8-9.6 µm, clavate, cylindrical, fusoid, cylindric-clavate, pyriform, some thick-walled, hyaline or pale grayish yellow in KOH; *dermatobasidia* 28-40.8 × 7.2-8 µm, 1-2 sterigmate, basidiospores from dermatobasidia 13.6-14.4 × 4.8 µm, fusoid.

Habitat: Gregarious under *Pinus caribaea* and *Quercus* spp.

Known distribution: Belize and Guatemala in Central America.

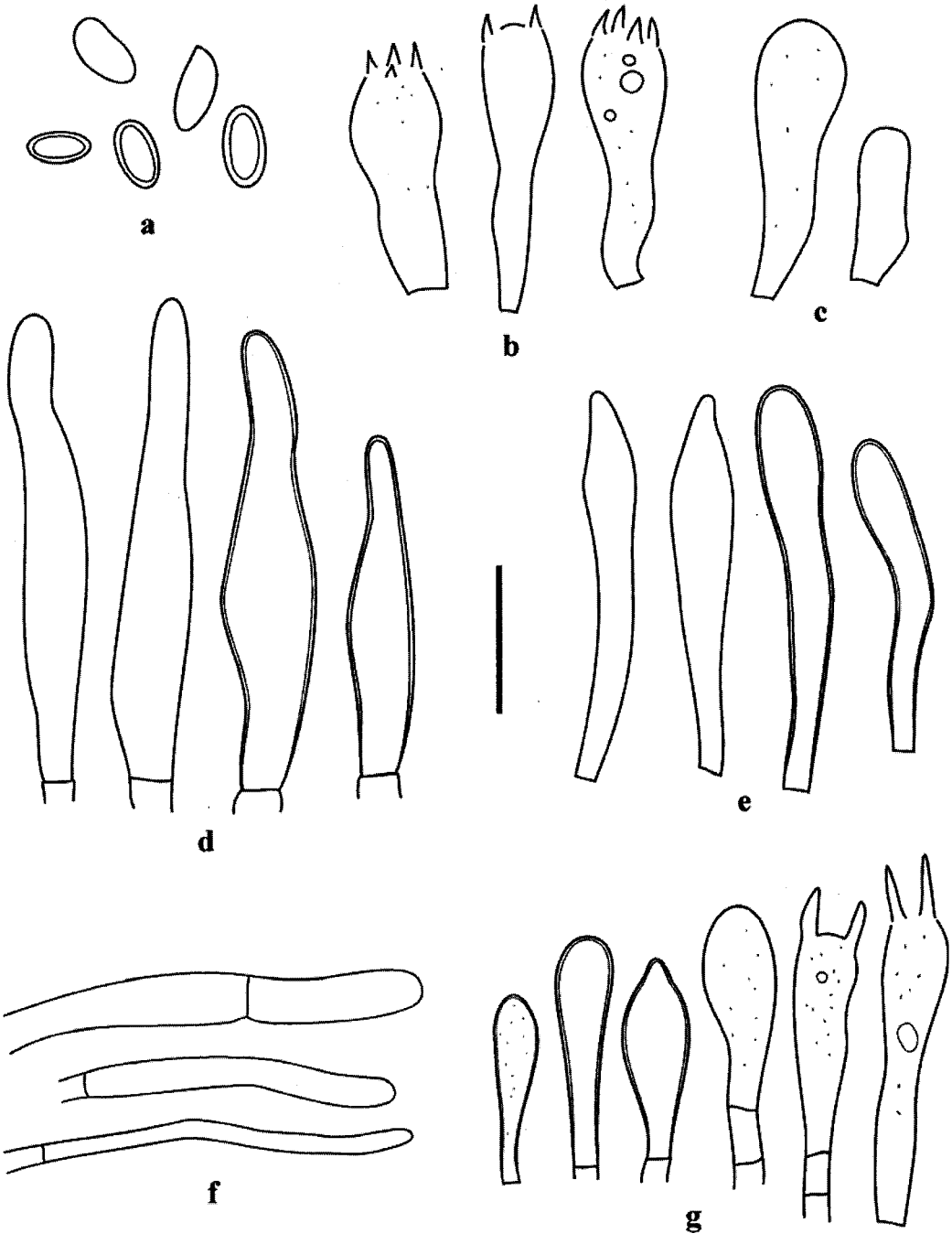


Fig. 36. *Boletus guatemalensis*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia and dermatobasidia. *BOS 354.* Scale bar = 20 µm.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva Forestry Station, camp ground, 16°58'22.9"N, 88°59'44"W, 456 m asl, 13 October 2002, *BOS 354,* BZ 1703 (BRH, CFMR); Macal River, Guacamayo Bridge at the oak stand above river, 16°53'16.2"N, 89°2'22.2"W, 594 m asl, 14 October 2002, *TJB 9392*, BZ 2112 (CORT, CFMR); Five Sisters Lodge, Nature Trail, 17°2'16"N, 88°59'8"W, 375 m asl, 21 October 2002, *BOS 391*, BZ 1740 (BRH, CFMR).

Notes: *Boletus guatemalensis* is characterized by the pink-red tones over the pileus and stipe surfaces, the non-cyanescent context and hymenophore, and the presence of thick-walled cystidia. Our collections differ from the original description of *B. guatemalensis* (R. Flores and Simonini, 2000) in having a pale yellow instead of white pileus context color.

Boletus guatemalensis belongs to the *Boletus weberi* complex of Section *Luridi*. One of the main characteristics that differentiate *B. guatemalensis* from other species is the non-bluing hymenophore and context, which is rare among members of Section *Luridi*. It is related to *Boletus morrisii* Peck, *B. rubropictus* Snell & A.H. Sm. and *B. weberi* Singer from North America. *Boletus morrisii* has a smoky brown pileus and a yellow context that stains red in the stipe; *B. rubropictus* has a fibrillose-scaly pileus surface of rosy red to brown colors and its cystidia are thin-walled; *B. weberi* has a pileus with yellow and dark brown colors and larger basidiospores (9.5-15.3 × 4-6.5 µm vs. 9.6-11.2 × 4.8-5.6 µm). *Boletus guatemalensis* is also related to *Xerocomus macrobbii* McNabb from New Zealand and *Boletus granulopunctatus* Hongo from Japan. *Xerocomus macrobbii* has a subtomentose to fibrillose-scaly pileus with olive ground color and yellowish brown to red exposed context while *B. granulopunctatus* has a pileus with more olivaceous colors and septate pleurocystidia.

19. ***Boletus hypocarycinus*** Singer, Mycologia 37: 798 (1945). (Figs 37, 42)

Synonym:
Suillellus hypocarycinus (Singer) Murrill, Lloydia 11: 29 (1948).

Pileus 44 (-60) mm diam., convex, velvety or tomentose, not viscid; Warm Sepia (7F5-6) to Sepia (5A1-2), not bruising, negative in KOH and NH_4OH; margin decurved, with a paler band. *Context* soft, moist, pale yellow, bruising blue, yellow orange in KOH, pale orange in NH_4OH; 8 mm thick at center, 4 mm at margin. *Odor* none. *Taste* mild, sweet. *Tubes* adnexed, 3 (-6) mm long, pale yellow, bruising blue; *pores* circular, 3/mm, stuffed, Orange Rufous (7C6-7) or reddish brown, bruising dark blue. Stipe 60 mm long, 14-16 mm wide, equal to slightly clavate, pruinose, basal area with a scant yellowish brown, brown or buffy tan tomentum; ground color Buff Yellow (4A4-4B5) to Tawny Olive (5C4) with red or brownish red pruina. *Context* firm, white or whitish yellow becoming brownish red in one side, bruising pale blue above

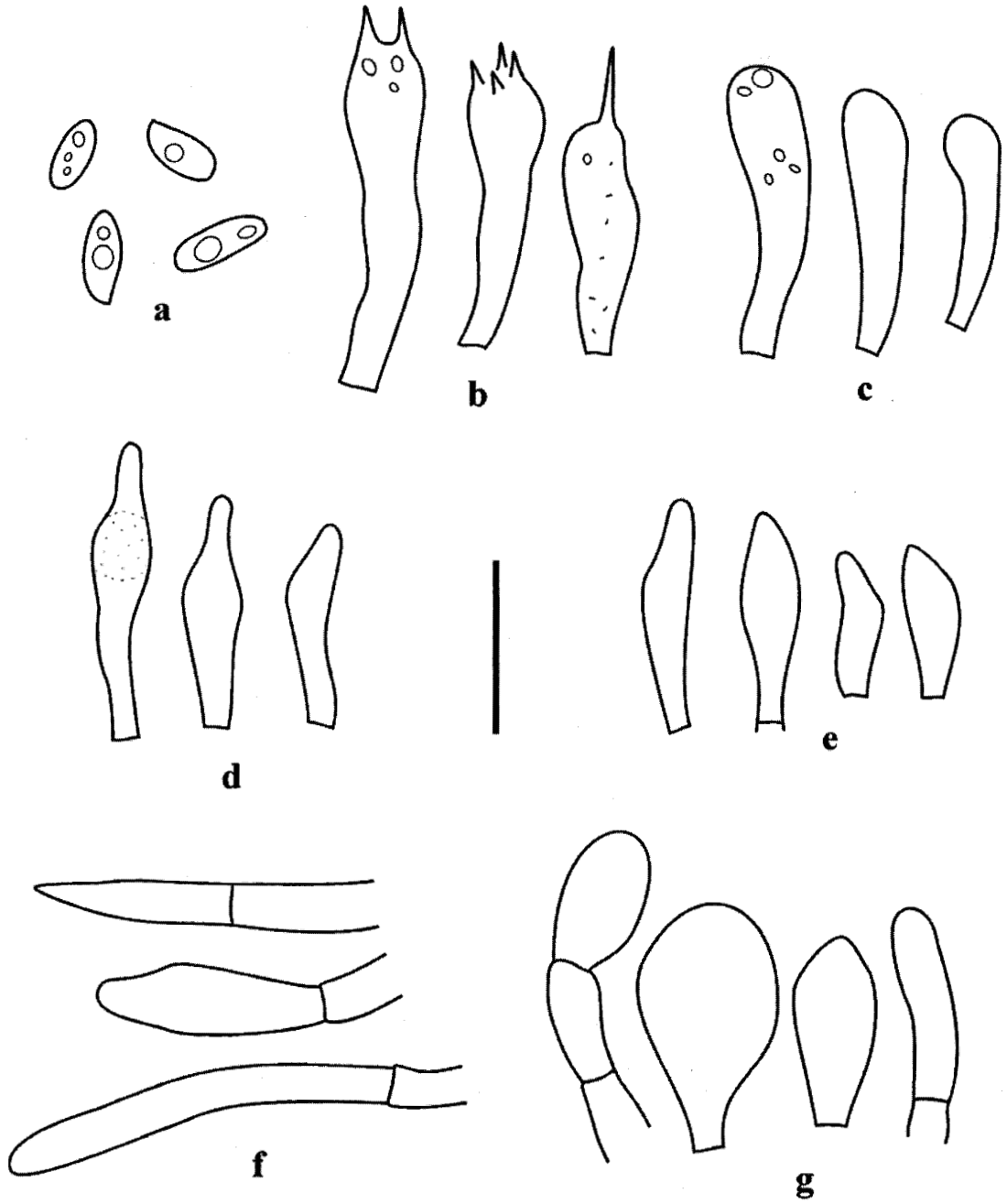


Fig. 37. *Boletus hypocarycinus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Pileocystidia; **g.** Caulocystidia. *DJL-BZ-30.* Scale bar = 20 µm.

and pale gray below, negative in KOH and NH_4OH; worm hole color Mahogany Red (8D6). *Basal mycelium* white. *Spore print* not obtained.

Basidiospores 8-11.2 × 3.2-4.8 µm (n = 20; 9.4 ± 1.27 × 4.04 ± 0.48; Q_m = 2.33 ± 0.23), elliptical, few, pale green in KOH, some dextrinoid in Melzer's. *Basidia* 25.6-38.4 × 8 µm, clavate to cylindric-clavate, (1-2) 4-sterigmate. *Basidioles* 24-32 × 5.6-8 µm, clavate. *Pleurocystidia* 22.4-33.6 × 4.8-5.6 µm, few, fusoid-ventricose to fusoid, some with melleous contents. *Cheilocystidia* 16.8-25.6 × 4.8-6.4 µm, numerous, fusoid-ventricose, ventricose rostrate. *Pileipellis* a tangled layer of repent to suberect hyphae 4-7.2 µm diam., with grayish yellow contents in KOH; end cells 17.6-44 × 4.8 µm, clavate or cylindrical, some with an acute or subcapitate apex, some moderately thick-walled, grayish yellow in KOH, dextrinoid in Melzer's. *Stipitipellis* hyphae 3.2-11.2 µm diam., subparallel, hyaline or with golden yellow contents in KOH. *Caulocystidia* 15.2-28 × 5-15.2 µm, clavate, globose, pyriform; hyaline in KOH.

Habitat: Solitary on soil under *Pinus caribaea* and *Quercus spp.*

Known distribution: North Carolina to Florida, west to Mississippi and south to Mexico in North America; Belize in Central America (first report in Central America).

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 12 October 2002, *TJB 9380*, BZ 2100 (BRH, CORT, CFMR); 18 October 2002, *DJL-BZ-30*, BZ 1827 (BRH, CFMR).

Notes: *Boletus hypocarycinus* is characterized by the brown color of the pileus, the red pores and the red to reddish brown pruina over stipe contrasting with the pale yellow ground color of the stipe. It belongs to Section *Luridi*, resembling *Boletus luridiformis* Rostkovius, which has a dark brown to reddish brown to olive brown pileus and larger basidiospores (14-16.6 × 4.7-5.9 µm vs. 8-11.2 × 3.2-4.8 µm). Our collection differs from those described by Singer (1947) in having a darker brown (deep red brown) pileus instead of brown or yellowish brown and somewhat smaller cheilocystidia (16.8-25.6 × 4.8-6.4 µm vs. 28-38 × 4.5-7 µm).

20. ***Boletus inedulis*** (Murrill) Murrill, Mycologia 30: 525 (1938). (Figs 38, 43)

Synonym:
Ceriomyces inedulis Murrill, Mycologia 30: 523 (1938).

Pileus 25-75 mm diam., broadly convex to convex, depressed at center, finely felty overall, not viscid, sand color (4B3-5B2) to Drab Gray, Drab (5D4) or Dark Drab (5E4) becoming in some areas Hair Brown (5F5) with age, Sayal Brown (6D5) in KOH, negative in NH_4OH; worm hole color brown; margin incurved to decurved. *Context* soft, pale yellow bruising pale blue, brownish

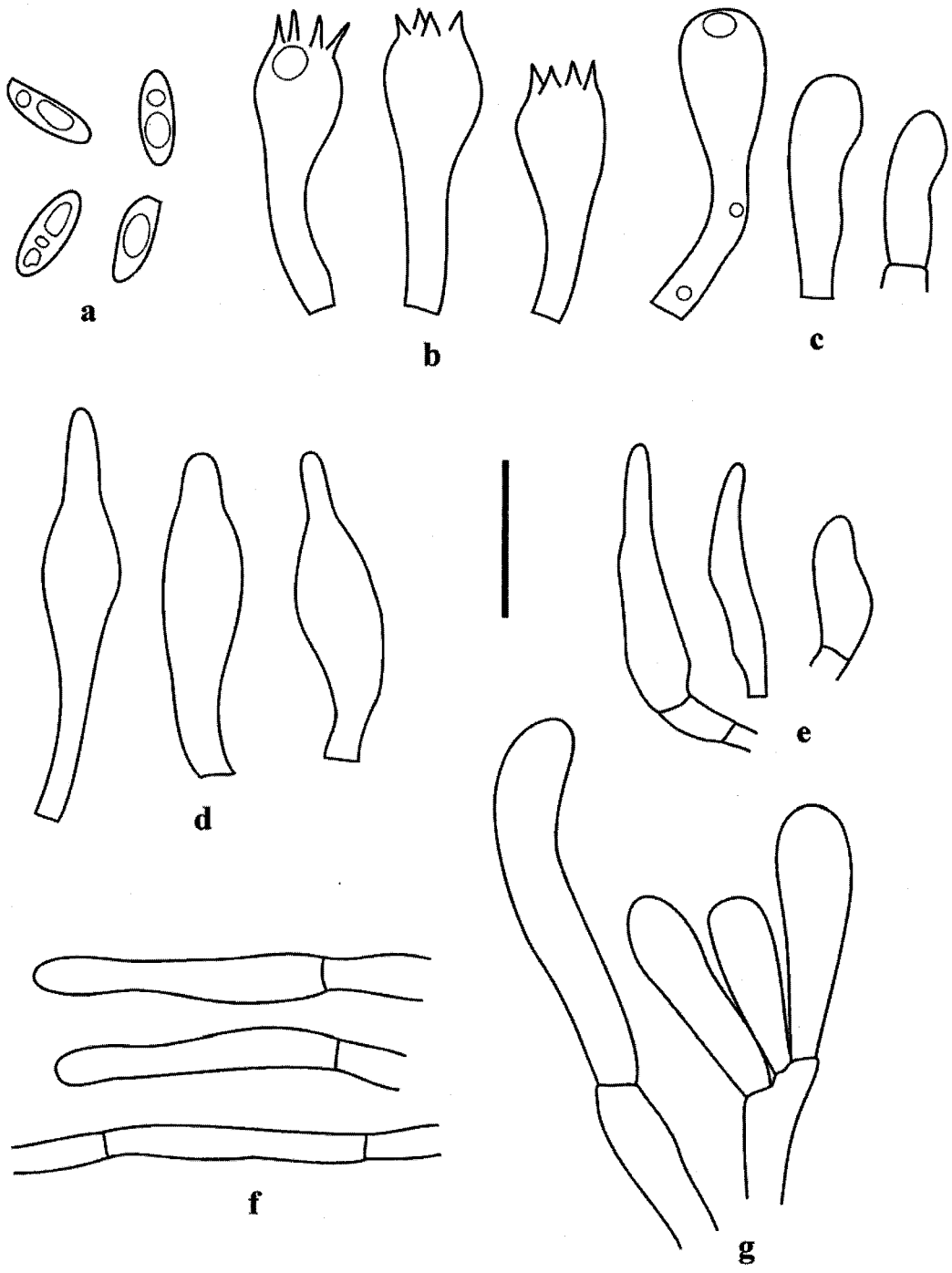


Fig. 38. *Boletus inedulis*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 363*. Scale bar = 20 µm.

yellow to Warm Buff (4-5A4) in KOH, negative in NH_4OH; 5-17 mm thick at center, 3-5 mm at margin. *Odor* sweet. *Taste* very bitter. *Tubes* adnexed with long decurrent tooth, 1-6 mm long, pale Sulfur Yellow (2A5), bruising blue, brownish yellow in KOH, becoming paler in NH_4OH; *pores* angular, 2/mm, Sulfur Yellow (2A5), bruising Indigo Blue (19F8). *Stipe* 42-83 mm long, 8-20 mm wide at apex, 8-15 mm at middle, 8-11 mm at base, equal or tapered at base, finely pruinose, fibrillose to tomentose lower half, not viscid; ground color Sulfur Yellow (2A5) at apex, pale Buff (4B4) to base, with a Brick Red (8-9E8) tint mainly from middle to base; bruising blue, dark reddish brown in KOH and reddish brown in NH_4OH; worm hole color brownish red. *Context* fibrous, solid, pale yellow bruising Indigo Blue (19F8), yellowish brown to reddish brown in KOH, brownish yellow in NH_4OH. $FeSO_4$ negative in all parts. *Basal mycelium* pale yellow. *Spore print* olive brown.

Basidiospores 11.2-13.6 × 4-5.6 µm (n = 20; 12.16 ± 0.76 × 4.36 ± 0.48; Q_m = 2.82 ± 0.32), subfusiform, greenish yellow with brown wall in KOH, pale yellowish orange with brown wall in Melzer's. *Basidia* 25.6-36 × 11.2-12 µm, clavate, 4-sterigmate. *Basidioles* 20-40 × 6.4-10.4 µm, clavate. *Pleurocystidia* 36-52 × 8.8-10.4 µm, fusoid-ventricose, fusoid-ampullaceous or cylindric-fusoid. *Cheilocystidia* 16.8-33.6 × 3.2-6.4 µm, numerous, fusoid or cylindric-fusoid. *Pileipellis* a tangled layer of thin repent hyphae 2.4-5.6 µm diam., subgelatinous or encrusted in yellow pigments, with golden yellow to ochre contents in KOH and Melzer's; end cells cylindrical. *Stipitipellis* hyphae 3.2-10.4 µm diam., interwoven, hyaline in KOH. *Caulocystidia* 16.8-48 × 5.6-9.6 µm, cylindrical to clavate, some with yellowish brown contents in KOH.

Habitat: Gregarious or solitary under *Quercus peduncularis*, *Q. oleoides* and *Pinus caribaea*.

Known distribution: Eastern Canada to Florida, west to Michigan and south to Mexico in North America; Belize in Central America (first report for Central America).

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Five Sisters Lodge, near fork in entrance road to Lodge, 17°2'20.2"N, 88°58'16.2"W, 432 m asl, 15 October 2002, *BOS 363,* BZ 1712 (BRH, CFMR); November 2002, *BOS 460*, BZ 2387 (BRH, CFMR); 29 November 2002, *BOS 476,* BZ 2404 (BRH, CFMR). Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 12 October 2003, *TJB 9715,* BZ 3258 (CORT, CFMR).

Notes: *Boletus inedulis* can be distinguished by the whitish cream or whitish gray tones of the pileus, yellow tubes with concolorous pores, red tones over a yellow ground on the stipe, with or without a reticulum and the very bitter taste. Our collections agree with those described by Singer (1947), though most of them lacked a reticulum; only collections BOS 460 and TJB 9715 had a reticulum, differring from Singer's collections in being yellow rather than red.

21. ***Boletus mahoganicoloroides*** B. Ortiz, Both & T.J. Baroni, **sp. nov.**
(Figs 39, 44-45)

MycoBank: 511049

Etymology: *mahoganicoloroides* - the color of mahogany wood; named for the color of the pileus, pores and stipe pruina.

Pileus coactus, fibrillosus, super discum rimulosus, rubrobrunneus demum lateritius. *Contextus* flavidulus, caerulescens. *Tubi* et pori caerulescens, tubi flavi, adnexi, *pori* aurantio-rubri. *Stipes* vinaceus, aequus, ad basim accuminatus, intus luteolus, praecipue caerulescens ad apicem.

Pileus 33-97 mm diam., broadly convex to convex or plane, smooth to finely felty or appressed fibrillose, becoming rimulose at center, not viscid, shiny in some areas, Mahogany Red (8D6) to Brick Red (8-9E8), becoming Grayish Horn Color (5E3) to olive brown in some areas, bruising Sepia (5A1-2), negative in KOH and NH_4OH; margin plane. *Context* pale yellow, some with pale Brick Red (8-9E8) areas, bruising blue, pale grayish vinaceous in KOH, negative in NH_4OH; 9-18 mm thick at center, 5-7 mm at margin. *Odor* bread-like. *Taste* sweet. *Tubes* adnexed, shallowly depressed near stipe, 3-8 mm long, yellow, bruising blue, yellowish brown in KOH, negative in NH_4OH; *pores* circular, 2/mm, orange red to Brick Red (8-9E8) to reddish brown, bruising dark greenish blue. *Stipe* 42-57 mm long, 7-22 mm wide at apex, 8-21 mm at middle, 8-20 mm at base, equal with tapered base, pruinose above, appressed fibrillose below; ground color yellow at apex, Flesh Color (7B3) to Vinaceous (11B5) below with Brick Red (8-9E8) to Burnt Sienna (8F6-7) pruina or fibrils; brown in KOH, negative in NH_4OH. *Context* fibrous, pale yellow or Pale Pinkish Buff (5B3) with a Brick Red (8-9E8) area at center from middle to base, bruising blue mainly at apex, becoming Prout's Brown (7F4) at base. *Basal mycelium* whitish yellow with olive brown areas. *Spore print* not obtained.

Basidiospores 8.8-12 × 4-4.8 µm (n = 20; 10.72 ± 0.98 × 4.28 ± 0.39; Q_m = 2.52 ± 0.26), fusiform, smooth, grayish green or yellowish grayish-green in KOH, orange to orange brown or dextrinoid in Melzer's. *Basidia* 18.4-28.8 × 8.8-9.6 µm, clavate, 2 or 4-sterigmate, some with orange brown contents in Melzer's. *Basidioles* 18.4-32 × 8.8-9.6, clavate. *Pleurocystidia* 32.8-56.8 × 5.6-10.4 µm, fusoid, fusoid-ventricose, fusoid-ampullaceous. *Cheilocystidia* 25.6-42.4 × 4-8 µm, fusoid, fusoid ventricose, or cylindrical, some collapsed, some with yellowish brown contents in KOH. *Pileipellis* a tangled layer of repent to suberect hyphae 4-13.6 µm diam., subgelatinous or encrusted in some areas, encrusting pigments bright orange brown or bright reddish brown in H_2O, dissolving very quickly with the application of KOH, producing a red color reaction; contents yellowish brown to brown in KOH, orange brown to slightly dextrinoid in Melzer's; end cells 51.2-70.4 × 7.2-8.8 µm, cylindrical to fusoid,

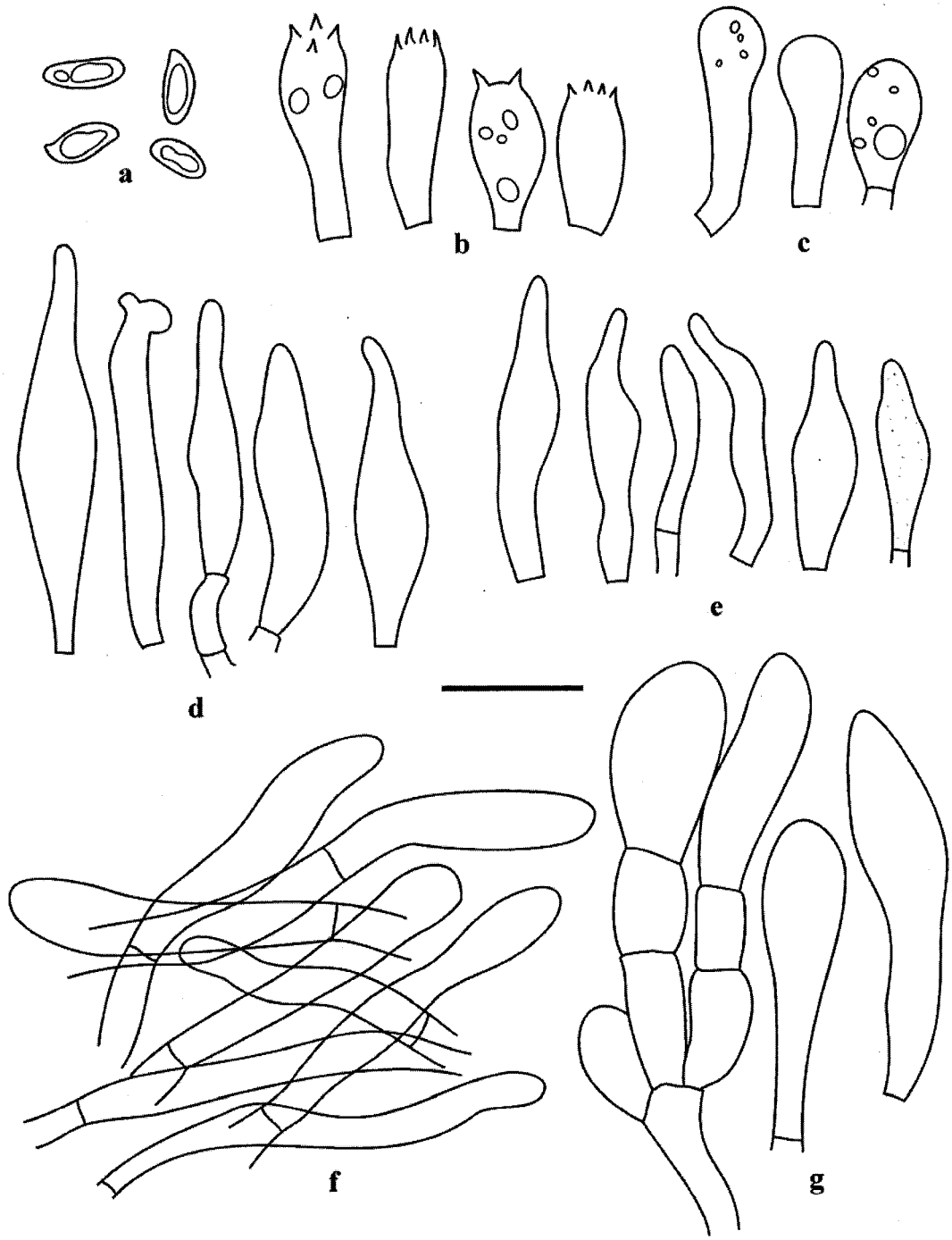


Fig. 39. *Boletus mahoganicoloroides*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Pileipellis; **g.** Caulocystidia. *BOS 322.* Scale bar = 20 μm.

hyaline or with yellow or dark brown contents in KOH, golden yellow or dextrinoid in Melzer's. *Stipitipellis* hyphae 3.2-8.8 µm diam., interwoven, pale grayish yellow in KOH, orange to dextrinoid in Melzer's, giving rise to clusters of *caulocystidia*; these 16-80 × 9.6-14.4 µm, clavate, broadly clavate, obpyriform, fusoid, fusoid ventricose, golden yellow in KOH, some orange brown in Melzer's.

Habitat: Gregarious under *Pinus caribaea.*

Known distribution: Belize.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, Forestry Station camp ground, 16°58'22.9"N, 88°59'44"W, 456 m asl, 31 July 2002, *BOS 231*, BZ 1577 (BRH, CFMR); 4 October 2002, *BOS 322,* BZ 1671 (CFMR, **holotype**; BRH, **isotype**).

Notes: *Boletus mahoganicoloroides* is distinguished by the Mahogany Red (8D6) to Brick Red (8-9E8) colors of the pileus, pores and stipe pruina, though the pileus becomes Grayish Horn Color to olive brown with age. It has a cyanescent hymenophore and context, with a rapid and strong bruising reaction and its basal mycelium is whitish yellow with olive brown areas. It belongs to Section *Luridi*, having similarities with *Boletus luridiformis* and its relatives. *Boletus luridiformis* differs in having a dark brown rather than red brown pileus, paler pruina (red to orange red), longer basidiospores (14-16.6 µm vs. 9.6-12 µm) and larger basidia (30-40 µm × 10-15 µm vs. 18.4-28.8 µm × 8.8-9.6 µm according to Breitenbach and Kränzlin, 1991). *Boletus miniatoolivaceus* Frost has pores mainly concolorous with tubes (yellow) rarely red, light cadmium stains near base and sphaerocysts in the pileipellis. *Boletus subluridellus* A.H. Sm. & Thiers has a paler pileus (orange red) bruising violet, a yellow stipe, longer basidiospores (11-15 µm vs. 9.6-12 µm) with an apical pore and different cystidia (clavate to fusoid ventricose instead of fusoid). *Boletus subvelutipes* Peck has more yellow tones over the pileus surface, has a red strigose-tomentum at the base and larger basidiospores (11-16.5 × 4.5-6.2 µm vs. 9.6-12 × 4-4.8 µm). *Boletus caribaeus* has pores concolorous with tubes (yellow) rather than orangish red to reddish brown.

22. ***Boletus neotropicus*** B. Ortiz & T.J. Baroni, **sp. nov.** (Figs 40, 46)
MycoBank: 511050

Etymology: *neotropicus* - from the Neotropics.

Pileus tomentosus, demum areolatus, atroumbrinus. *Contextus* vivide citrinus, celeriter pallidior, profunde caerulescens. *Tubi* aurei-lutei, adnati, *pori* concolores, celeriter caerulescens. *Stipes* ubique pruinosus, sursum aureo-flavus, deorsum purpureo-rubeus, intus ad apicem citrinus, in basim rhubarbarinus.

Pileus 20-27 mm diam., convex, densely matted tomentose becoming subrimose-areolate, dry, dark brown (5F7-8 to 6F4-5); margin inrolled; tubes extending to margin. *Context* bright lemon yellow becoming quickly paler

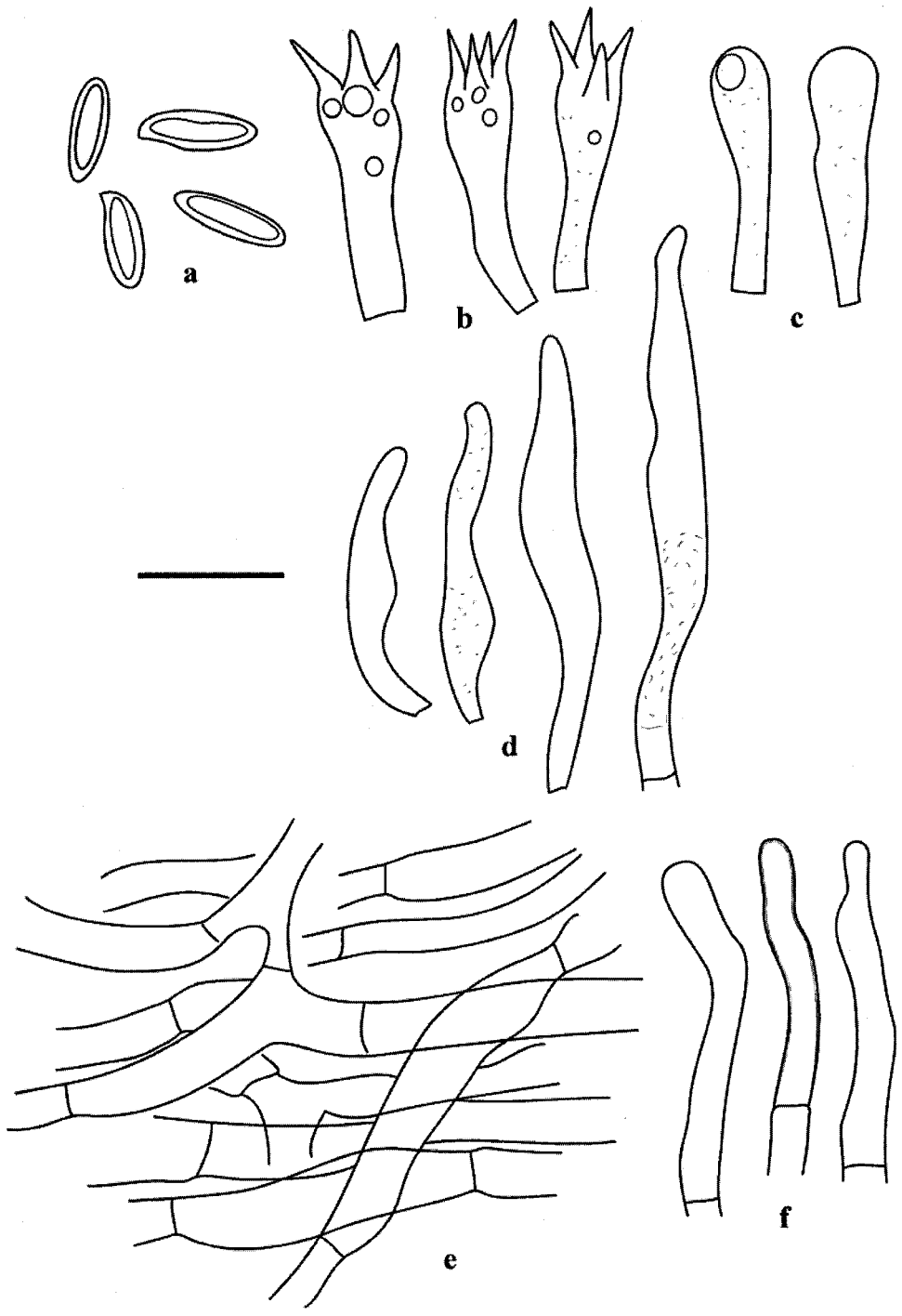


Fig. 40. *Boletus neotropicus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** Pileipellis; **f.** Caulocystidia. *TJB 9821.* Scale bar = 20 µm.

yellow then erratically deep blue; 4-5 mm thick at center. *Odor* not distinctive. *Taste* mild. *Tubes* adnate, 2-3 mm long, bright golden yellow (3A6); *pores* circular, 2/mm, bright golden yellow (3A6), duller with age (3A-B4), quickly bruising blue. *Stipe* 20-25 mm long, 3-4 mm wide, equal; densely pruinose overall, golden yellow at apex, purple red to base (8-10D7-8). *Context* solid, lemon yellow at apex, rhubarb red in basal area. *Basal mycelium* pale white. *Spore print* not obtained. *Macro-chemical reactions* not obtained.

Basidiospores 12-16 × 4-4.8 µm (n = 20; 13.76 ± 1.48 × 4.6 ± 0.36; Q_m = 3.02 ± 0.49), fusiform, smooth, yellowish green with dark brown wall in KOH, some dextrinoid in Melzer's. *Basidia* 27.2-32.8 × 8-8.8 µm, clavate, 4 long-sterigmate. *Basidioles* 26.4-35.2 x 6.4-8.8 µm, clavate. *Hymenial cystidia* 28-76 × 6.4-8 µm, fusoid, cylindric-fusoid, some with golden yellow or yellowish brown contents in KOH, dextrinoid in Melzer's. *Pileipellis* a loosely tangled layer of repent hyphae 3.2-9.6 µm diam., encrusting pigments yellowish brown to brown in H_2O, dissolving after the application of KOH, producing a yellowish brown to bright orange brown color reaction; hyaline or with grayish yellow contents in KOH, some dextrinoid in Melzer's; end cells cylindrical, thin to moderately thick-walled. *Stipitipellis* hyphae 3.2-11.2 µm diam., branched, interwoven, some slightly thick-walled, hyaline or grayish yellow in KOH, dextrinoid in Melzer's; end cells 26.4-56 × 4.8-5.6 µm, cylindrical, hyphoid, with grayish yellow to golden yellow contents in KOH.

Habitat: Gregarious on soil, under Magnolia and near *Quercus* sp. in cloud forest.

Known distribution: Belize.

Material examined: BELIZE. Cayo District: Chiquibul Forest Reserve, Doyle's Delight, South Trail, 16°29'N, 89°2'W, 1134 m asl, 11 August 2004, *TJB 9821,* BZ 3521 (CORT, **holotype**; CFMR, **isotype**).

Notes: *Boletus neotropicus* is distinguished by the small basidiocarps with dark brown pileus, golden yellow hymenophore that stains blue and yellow stipe with red pruina, growing under hardwoods. Considering some of these characteristics, such as small fruitbodies and a pruinose stipe, *B. neotropicus* can be placed in Section *Subpruinosi*. It differs from *Boletus fraternus* Peck in pileus color, which is dark brown instead of deep to dull red and its stipe context does not stains dark greenish blue after bruising. *Boletus campestris* A.H. Sm. & Thiers has a rose-red pileus, its tubes are depressed instead of adnate, the stipe context stains greenish blue and its basal mycelium is yellow instead of white.

23. ***Boletus occidentalis*** B. Ortiz & T.J. Baroni, **sp. nov.** (Figs 47, 53)
MycoBank: 511051

Etymology: *occidentalis* - associated with *Pinus occidentalis*.

Pileus velutinus demum minute punctato-pruinatus, ubi juvenis umbrinus demum flavo-brunneus. *Contextus* albus, immutabilis. *Tubi* flavi-viridi, adnexi, *pori* albi demum concolores. *Stipes* albidus vel pallide avellaneus, reticulatus, reticulum compositus, concoloris, intus albus, immutabilis.

Pileus 35-150 mm diam., convex to plane-convex, then plane with age, smooth, densely velvety at first, becoming minutely punctate pruinate overall with expansion, slightly tacky but not viscid, dark brown (6E-F6-7) in button stages, quickly becoming paler to yellow brown (5C4-5 to 5D5) with expansion; margin with a white floccose pubescent edge when young (and inrolled), absent with age. *Context* white, unchanging when bruised, solid; 15-25 mm thick at center. *Odor* not distinctive. *Taste* mild or sweet. *Tubes* adnexed, 4-12 mm length, yellow green to olivaceous; *pores* circular, mostly 1/mm, white and stuffed at first, soon yellow green to olivaceous with age, remaining white near pileus margin, unchanging when bruised. *Stipe* 65-115 mm long, 10-25 mm wide, equal or slightly clavate with a tapered base; ground color white to pale tan (near 5C4 or 5B3) with white base; reticulum concolorous with surface, compound from apex to base, coarse, with meshes 4-10 mm long and 1-2 mm apart. *Context* white and solid. *Spore print* not obtained. *Macro-chemical reactions* not obtained on fresh samples, NH_4OH negative over pileus and stipe surfaces on dried material.

Basidiospores 11.2-15.2 × 4-4.8 µm (n = 20; 13.2 ± 1.81 × 4.16 ± 0.33; Q_m = 3.19 ± 0.49), fusiform, smooth, yellowish gray in KOH, yellowish brown or dextrinoid in Melzer's. *Basidia* 32.8-37.6 × 9.6-11.2 µm, clavate, (2-) 4-sterigmate. *Basidioles* 20-32.8 × 8.8-10.4 µm, clavate. *Pleurocystidia* 37.6-48 × 4.8-8 µm, cylindrical or fusoid. *Cheilocystidia* 32.8-48.8 × 5.6-7.2 µm, fusoid, fusoid ventricose, subclavate or cylindrical. *Pileipellis* a tangled layer of repent to suberect hyphae 4-13.6 µm diam., subgelatinous, encrusted pigments golden yellow in H_2O, with little diffusion (pale yellow) after the application of KOH; contents pale yellow or pale yellowish brown in KOH, golden yellowish brown in Melzer's; end cells 29.6-66.4 × 4.8-9.6 µm, fusoid, cylindrical or cylindric-clavate, clavate to broadly clavate, hyaline or grayish yellow in KOH. *Stipitipellis* hyphae 4-12.2 µm diam., interwoven, subgelatinous, hyaline in KOH. *Caulocystidia* 24-68.8 × 6.4-11.2 µm, numerous, in clusters, clavate, fusoid, fusoid ventricose to fusoid ampullaceous.

Habitat: Gregarious on humus under *Pinus occidentalis*.

Known distribution: Dominican Republic.

Material examined: DOMINICAN REPUBLIC. La Vega Province: Jarabacoa, road to golf course and El Salto de Jimenoa, 19°7'20"N, 70°36'28"W, 600 m asl, 9 November 2003, *TJB 9762*, DR 2834 (JBSD, CFMR); 10 November 2003, *TJB 9769*, DR 2841 (CORT, **holotype**; JBSD, CFMR, **isotypes**); Road to Jumanuco from Jarabacoa, 11 November 2003, *DJL-DR-17.1*, DR 2803 (JBSD, CFMR). Santiago Province: Los Montones Arriba, Plan Sierra

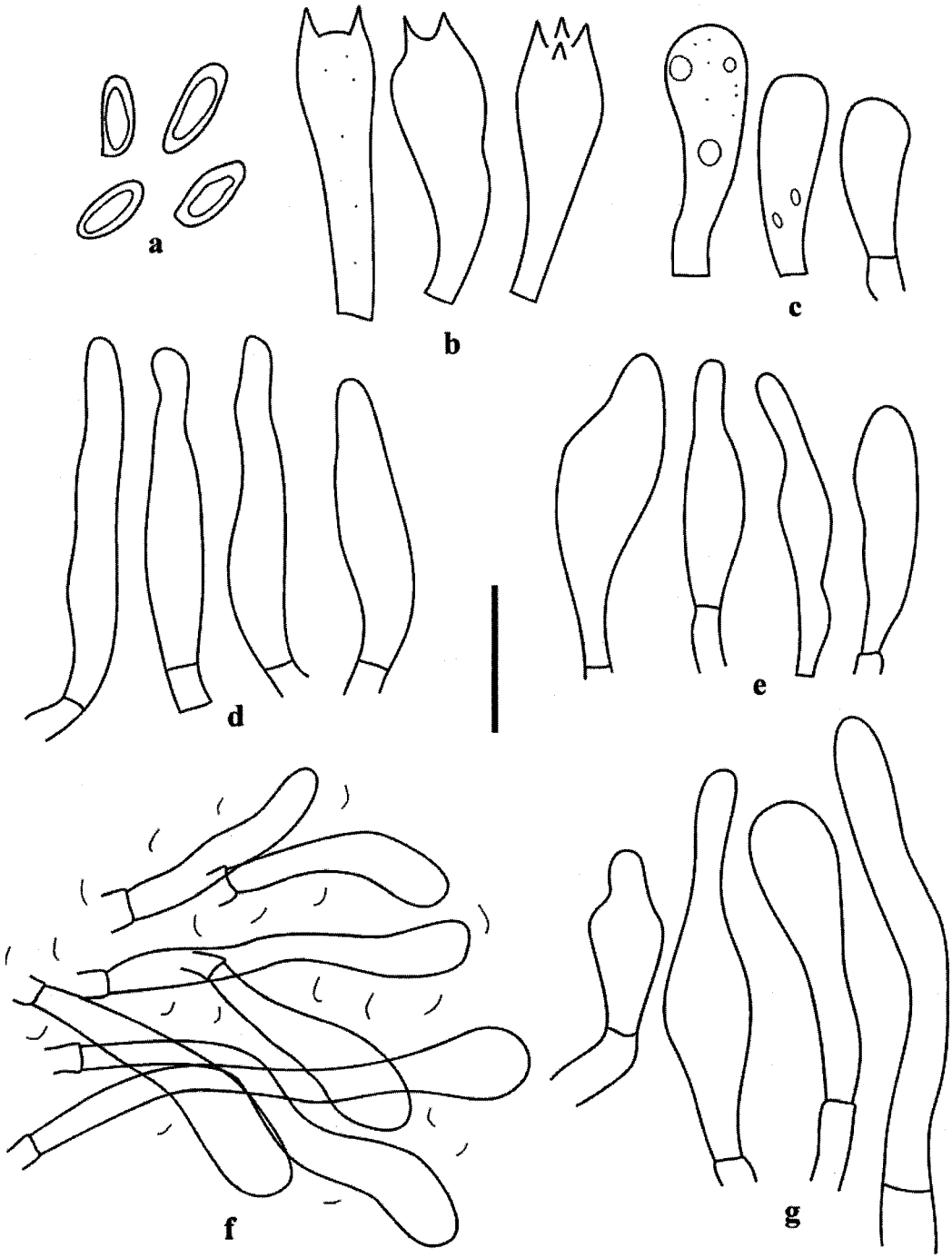


Fig. 47. *Boletus occidentalis*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia. **f.** End-cells of pileipellis; **g.** Caulocystidia. *TJB 9769*. Scale bar = 20 µm.

Conference Center, 19°17'18.4"N, 70°55'31.4"W, 800 m asl, 17 November 2003, *BOS 635*, DR 3031 (JBSD, CFMR).

Notes: *Boletus occidentalis* is distinguished by the dark brown to yellow brown pileus, a white context unchanging when bruised, yellow to yellow green tubes and pores and a coarsely reticulate stipe; these characteristics place it in Section *Boletus* in the *Boletus edulis* complex.

Several species in the *Boletus edulis* complex must be compared to this new taxon. The pileus of *Boletus edulis* Bulliard is viscid when wet and becomes pitted or wrinkled with age; the pileus color is mainly pale brown becoming reddish brown and the stipe reticulum is white and not coarse or deep. *Boletus pinophilus* Pilát & Dermek has a wrinkled tuberculate pileus; the reticulum is finer and shallower, and grades from whitish cream at the apex to brown below, where it is darker than the ground color, rather than being concolorous with the ground throughout, and its basidiospores are longer (15-20 µm vs. 11.2-16 µm). *Boletus subcaerulescens* (E.A. Dick & Snell) Both, A.E. Bessette & A.R. Bessette has a white context that becomes dull vinaceous above tubes and vinaceous near the pileipellis, the pores stain bluish gray then ochraceous to brown, the reticulum is not deep or coarse and the pileipellis stains bluish green then bright orange with the application of NH_4OH. *Boletus quercophilus* Halling & G.M. Muell. has a pileus with a tomentose to finely areolate surface with golden brown, mustard brown or light yellow colors when young but then becoming yellow ochre to brown, it also has somewhat shorter spores (9.8-13.3 vs. 11.2-15.2 µm) and longer hymenial cystidia (40-60 vs. 32.8-48.8 µm).

24. ***Boletus pallidus*** Frost, Bull. Buffalo Soc. Nat. Sci. 2: 105 (1874). (Figs 48, 54)

Synonyms:
Suillus pallidus (Frost) Kuntze, Rev. Gen. Pl. 3:536 (1898).
Ceriomyces pallidus (Frost) Murrill, Mycologia 1:152 (1909).

Pileus up to 70 mm diam., convex, felty, pallid, grayish buff, bruising brown. *Context* pallid, bruising blue instantly. *Odor* not distinctive. *Taste* bitter. *Tubes* adnexed with long decurrent tooth, olive yellow to olive green, bruising blue; *pores* concolorous bruising blue. *Stipe* pruinate-fibrillose overall, pallid, grayish buff or pink, bruising blue. *Context* white, with red tones at base, bruising blue. *Spore print* not obtained. *Macro-chemical reactions* not obtained.

Basidiospores 9.6-12.8 × 4-4.8 µm (n = 20; 11.32 ± 1.08 × 4.2 ± 0.36; Q_m = 2.70 ±0.25), subfusiform, grayish yellow in KOH, yellowish brown with a dark brown wall in Melzer's. *Basidia* 20-31.2 × 7.2-8.8 µm, clavate to subcylindrical, 4-sterigmate. *Basidioles* 20-29.6 × 8-8.8 µm, clavate. *Pleurocystidia* 49.6-52 × 8.8-10.4 µm, sublanceolate. *Cheilocystidia* 20-40.2 ×

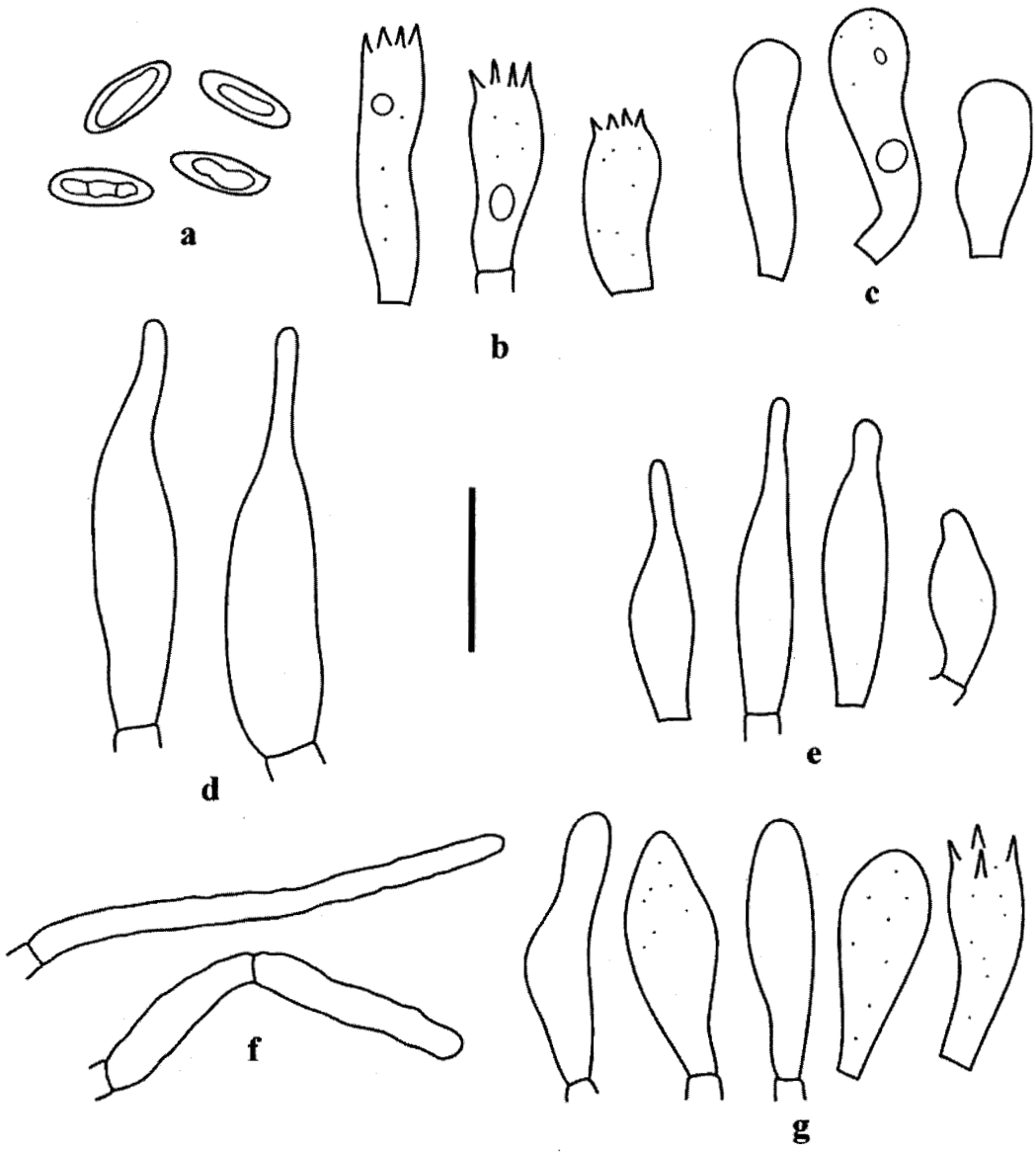


Fig. 48. *Boletus pallidus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia and dermatobasidium. *TJB 9322.* Scale bar = 20 µm.

5.6-8.8 µm, fusoid-ventricose, fusoid-ampullaceous to sublanceolate. *Pileipellis* a tightly tangled layer of repent hyphae 3.2-7.2 µm diam., subgelatinous or incrusted in yellow pigments; contents grayish yellow in KOH, golden yellow to yellowish brown in Melzer's; end cells cylindrical. *Stipitipellis* hyphae 3.2-8.8 µm diam., interwoven in some areas, hyaline or with pale grayish yellow

contents in KOH, giving rise to clusters of *caulocystidia*; these 17.6-38.4 × 6.4-11.2 µm, fusoid, clavate, fusoid-ventricose with grayish yellow or yellow contents in KOH; *dermatobasidia* present.

Habitat: Gregarious under *Quercus peduncularis* or *Quercus* spp.

Known distribution: Eastern North America, west to Michigan and south to Mexico; Belize in Central America (first report for Central America).

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Macal River, Guacamayo Bridge at the oak stand above river, 16°53'16.2"N, 89°2'22.2"W, 594 m asl, 5 October 2002, *TJB 9322*, BZ 2042 (BRH, CORT, CFMR).

Notes: *Boletus pallidus* is distinguished by the whitish cream to grayish buff tones of the pileus and stipe, the whitish yellow hymenophore that becomes olive green and the slow bluing reaction in the pileus context. Our collection differs from those described by Singer (1947) mainly in the rapid bluing reaction of the pileus context. The collections of *B. pallidus* studied by Smith and Thiers (1971) are described as having a nearly white context that often develops a trace of pink coloration where bruised and with only a slight tendency to turn blue when the specimens are very young and firm. In addition, the pleurocystidia in this collection are longer (49.6-52 µm vs. 35-44 µm) than those described by Smith and Thiers (1971), and these also differ in being fusoid-ampullaceous to sublanceolate instead of fusoid-ventricose.

25. ***Boletus projectelloides*** B. Ortiz, Both, Halling & T.J. Baroni, **sp. nov.**
(Figs 49, 55)

MycoBank: 511052

Etymology: *projectelloides* - resembling *Boletus projectellus*.

Pileus coactus, cinnamomeus, margo decurvatus, sterilis. *Contextus* albus. *Tubi* flavi demum olivaceo-flavi, *pori* concolores. *Stipes* minutissimis pruinatus, pallide avellaneus vel brunneus, intus albus, immutabilis. *Boletus projectellus* et *B. atkinsonianus* in mentem revocavit.

Pileus 20-70 (-79) mm diam., broadly convex, convex to plane-convex, felty overall, slightly tacky to touch, not viscid, Chamois (4A4) to pale Tawny Olive (5C4) to Cinnamon (5C4) or Clay Color (5D5) with yellow hues from superficial hyphal covering, negative in KOH and $FeSO_4$, a transient flash of deep blue green, then fuscous, fading to brown with a deep mahogany red drop in NH_4OH; margin inrolled to decurved, forming a sterile band. *Context* solid, white, unchanging in some, but bruising pale grayish vinaceous to Vinaceous (11B5) in others; 5-12 mm thick at center, 2-3 at margin. *Odor* not distinctive. *Taste* mild to slightly sour. *Tubes* deeply adnexed, (4-) 7-10 (-12) mm long, yellow or pale green becoming Olive Yellow (2C5), not bruising; *pores* circular to angular, 1-2/mm, yellow (3A4) becoming Olive Yellow (2C5). *Stipe* 70-80 (-144) mm long, 12-15 (-32) mm wide, equal, subclavate or clavate, longitudinally striate, slightly ridged-striate at apex, otherwise smooth, very

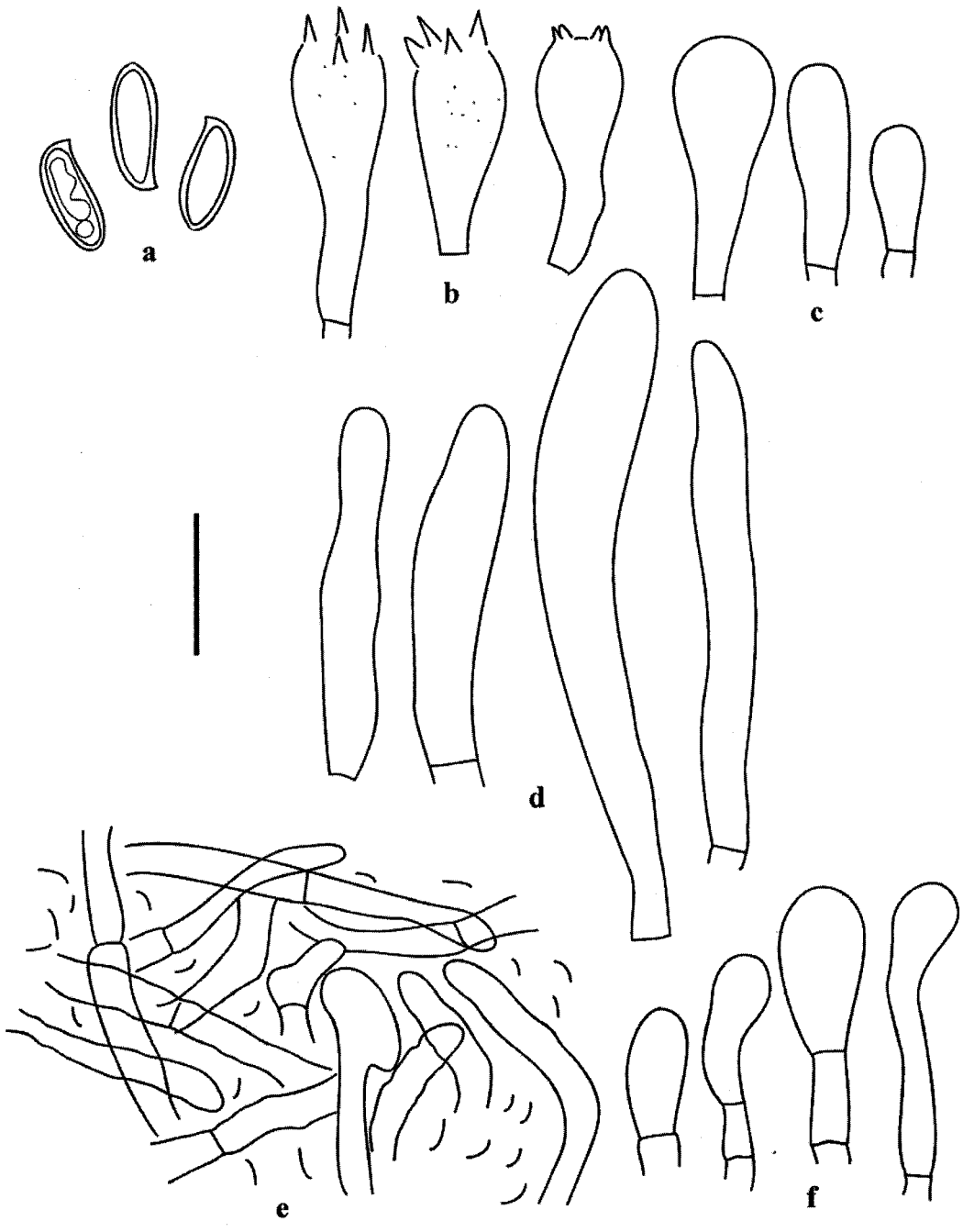


Fig. 49. *Boletus projectelloides*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** Pileipellis; **f.** Caulocystidia. *TJB 9385*. Scale bar = 20 µm.

minutely pruinate, pale tan (5A3-5B4), Tawny Olive (5C4) to Sayal Brown (6D5) and pallid white streaked throughout with pale yellow hues in base from exposed flesh. *Context*, solid, white, unchanging. *Basal mycelium* white.Context and tubes negative in KOH, NH_4OH and $FeSO_4$. *Spore print* not obtained.

Basidiospores 14.4-18.4 × 5.6-6.4 (-7.2) µm (n = 20; 16.21 ± 1.07 × 6 ± 0.48; Q_m = 2.71 ± 0.11), fusiform, smooth, cylindrical with a germ pore, smooth, thick-walled, bright greenish orange-yellow in KOH, grayish orange yellow to slightly dextrinoid in Melzer's. *Basidia* 28-40 × 9.6-12 µm, clavate, (2-) 4-sterigmate. *Basidioles* 16.8-36 (-42.4) × (4.8-) 7.2-13.6 µm, clavate. *Hymenial cystidia* (32-) 48-96 × (6.2-) 7.2-12 µm, cylindrical, cylindrical-fusoid. *Pileipellis* a tangled ixotrichoderm of hyphae 2.4-9.6 (-11.2) µm diam., encrusted pigments pale yellowish brown or golden yellow or greenish yellow in H_2O, dissolving after the application of KOH, producing a yellowish brown color reaction; hyaline or with bright grayish yellow (lemon yellow) or grayish green contents in KOH, bright grayish yellow or grayish yellowish brown in Melzer's; end cells cylindrical, some encrusted, branched, smooth or slightly wavy. *Stipitipellis* hyphae (2.4-) 3.2-11.2 µm diam., parallel or interwoven, with gray or grayish green or pale yellow contents in KOH. *Caulocystidia* (14.4-) 16.8-40.8 (-48) × (4-) 6.4-12 µm, clavate, cylindric-clavate, fusoid, hyaline or pale gray in KOH, grayish yellow in Melzer's; *dermatobasidia* (32-) 36-40 × 7.2-11.2 µm, clavate, (2-) 4-sterigmate.

Habitat: Gregarious under *Pinus caribaea*.

Known distribution: Belize.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 7 October 2002, *BOS 329*, BZ 1678 (BRH, CFMR); 14 October 2003, *REH 8553*, BZ 3334 (BRH, NY, CFMR); Tropical Education Center, 17°21'27"N, 88°32'30"W, 30 m asl, 6 August 2002, *BOS 243*, BZ 1589 (BRH); 17 October 2002, *BOS 369*, BZ 1718 (BRH, CFMR); 14 November 2004, *DJL-BZ-7*, BZ 4052 (BRH). Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, Forestry Station camp ground, 16°58'22.9"N, 88°59'44"W, 456 m asl, 13 October 2002, *TJB 9385*, BZ 2105 (CORT, **holotype**; CFMR, **isotype**); 19 October 2002, *BOS 380*, BZ 1729 (BRH, CFMR); near Forestry Station cabins, 16°58'23"N, 89°59'39"W, 450 m asl, 1 December 2002, *BOS 487*, BZ 2415 (BRH, CFMR); *BOS 488*, BZ 2416 (BHR, CFMR).

Notes: *Boletellus projectelloides* is distinguished by the cinnamon tones over the pileus and stipe surfaces and the non-cyanescent basidiome, its felty pileus, a longitudinally striate and long-clavate stipe, a yellow to olive yellow hymenophore, white context and fusiform basidiospores with a germ pore. Some of these characteristics differentiate it from the macroscopically similar *Boletus atkinsonianus* (Murrill) Sacc. & Trotter (Section *Cartilaginei*), *B. auriporus* Peck (Section *Auripori*) and *B. projectellus* (Murrill) Murrill (Section *Mirabiles*). *Boletus atkinsonianus* has a similar free sterile pileus margin, but it

differs from *B. projectelloides* in having a viscid pileus, basidiospores that are smaller (11-13 × 4-5 µm vs. 14.4-18.4 × 5.6-7.2 µm) and the absence of a germ pore on the spores. *Boletus auriporus* differs in having a bright yellow hymenophore, yellow floccules on the stipe and the absence of spores with germ pores. *Boletus projectellus* differs from *B. projectelloides* in having a reddish brown rather than pale yellowish brown pileus, a rosy context, a reticulate stipe and much larger basidiospores (18-33 × 7.5-12 µm vs. 14.4-18.4 × 5.6-7.2 µm) that lack a germ pore.

26. ***Boletus pseudofrostii*** B. Ortiz, **sp. nov.** (Figs 50, 56)
MycoBank: 511053

Etymology: *pseudo* - false; *frostii* - referring to *Boletus frostii*.

Pileus late convexus, viscidus in humide, vinaceus, ubi contusi lateritius. *Contextus* sulphureus, immutans. *Tubi* sulphurei, adnexi, immutabilis, *pori* carmesini, immutabilis. *Stipes* ventricosus, sulphureus vel carmesinus reticulatus, intus viridi-flavus, immutabilis.

Pileus 17-20 mm diam., broadly convex, felty, viscid when wet; Vinaceous (11B5), bruising Brick Red (8-9E8) to Maroon (10F8), orange yellow in KOH, negative in NH_4OH; margin decurved. *Context* Sulphur Yellow (3B5), not bruising blue, yellow orange in KOH, negative in NH_4OH. *Odor* and *taste* not determined. *Tubes* adnexed, 1-3 mm long, Sulphur Yellow (3B5); *pores* irregular, labyrinthine, Crimson (10C8) to Brick Red (8-9E8), not bruising blue. *Stipe* 38-46 mm long, 6-7 mm wide at apex, 8-11 mm at middle, 5-6 mm at base, ventricose, moderately to strongly reticulate; ground color Sulfur Yellow (2A5) with a Sulphur Yellow (3B5) or Crimson (10C8) reticulum; discoloring in KOH. *Context* solid, bright yellow, not bruising blue, negative in KOH and NH_4OH. *Basal mycelium* very fine, white. *Spore print* not obtained.

Basidiospores 7.2-12 × 4-6.4 µm (n = 20; 9.39 ± 1.33 × 4.8 ± 0.73; Q_m = 1.98 ± 0.32), ellipsoid, smooth, greenish yellow in KOH. *Basidia* 32.8-44.8 × 7.2-9.6 µm, cylindric-clavate, 4-long sterigmate. *Basidioles* 21.6-41.6 × 3.2-8 µm, clavate to cylindrical. *Pleurocystidia* 28-54.4 × 3.2-8.8 µm, fusoid, cylindrical, fusoid-ventricose, hyphoid. *Cheilocystidia* 18.4-48 × 4.8-8 µm, cylindrical, subfusoid, fusoid-ventricose, mostly hyphoid (some two-septate). *Pileipellis* a tangled layer of elongated repent hyphae 2.4-9.6 µm diam., subgelatinous in some areas, encrusted pigments coral red in H_2O, dissolving very quickly with the application of KOH, producing a vinaceous red or reddish brown color reaction; contents yellowish gray or golden yellow in KOH, yellow, bright reddish orange or dextrinoid in Melzer's; end cells cylindrical. *Stipitipellis* hyphae 2.4-9.6 µm diam., hyaline in KOH, giving rise to clusters of *caulocystidia*; these 14.4-28.8 × 8-8.8 µm, clavate, subfusoid or cylindric-clavate, yellow in KOH.

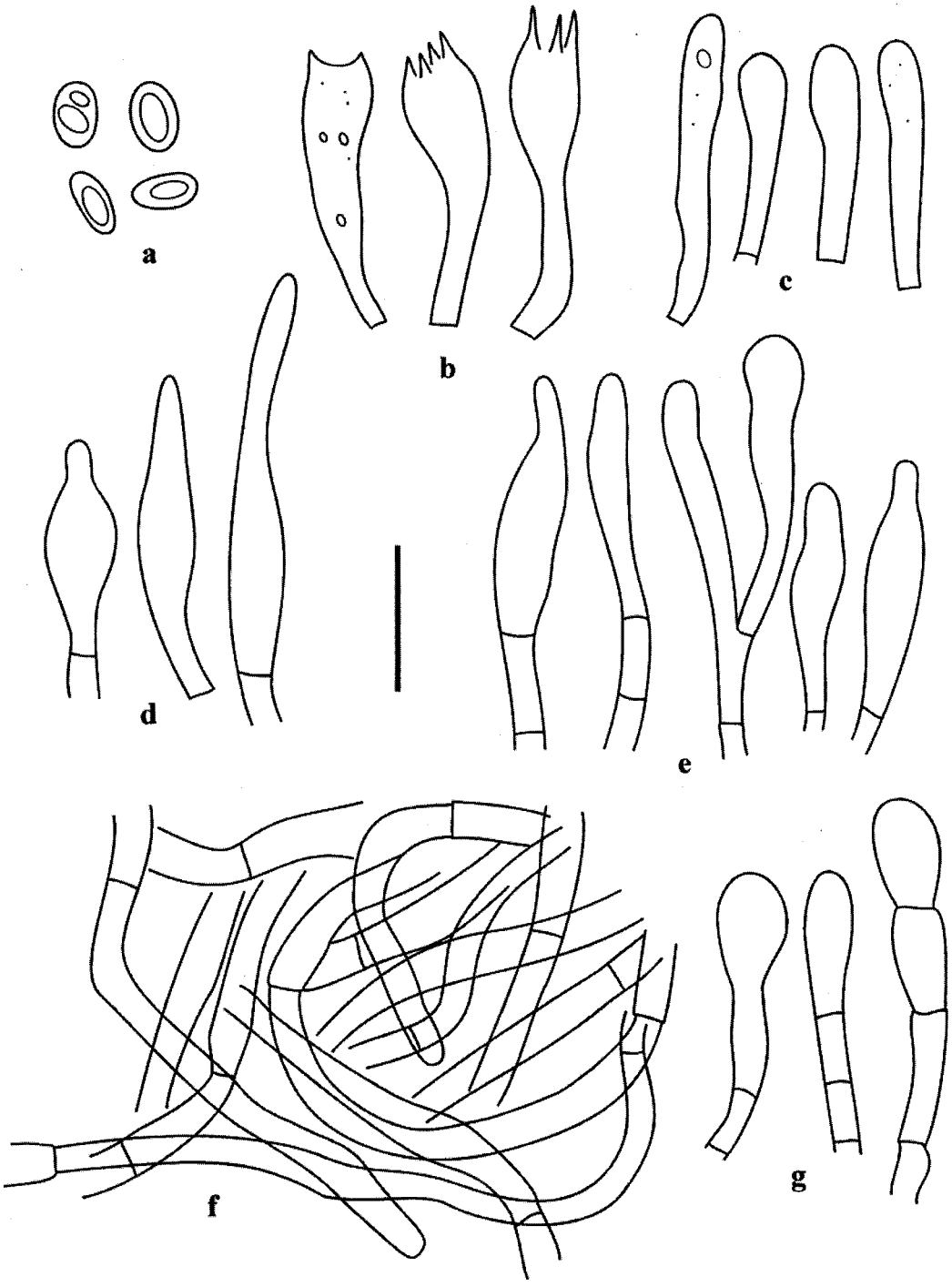


Fig. 50. *Boletus pseudofrostii.* **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Pileipellis; **g.** Caulocystidia. *BOS 266.* Scale bar = 20 µm.

Habitat: Gregarious under *Pinus caribaea*.

Known distribution: Belize.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, swamp near British Military Camp, 16°58'8.9"N, 88°59'38.4"W, 476 m asl, 11 August 2002, *BOS 266*, BZ 1611 (CFMR, **holotype**; BRH, **isotype**).

Notes: *Boletus pseudofrostii* is distinguished by its smaller size, red pores, red tones over pileus and stipe, the absence of cyanescent bruising reactions in all parts and a reticulate stipe. The red pores place it in Section *Luridi*. *Boletus pseudofrostti* resembles *B. frostii* in overall colors but it differs in smaller size, absence of blue brusing reactions in all parts and a coarsely reticulate stipe on yellow ground color that is not alveolate-reticulate.

27. ***Boletus roseoareolatus*** B. Ortiz & T.J. Baroni, **sp. nov.** (Figs 51, 57)

MycoBank: 511054

Etymology: *roseo* - rose color; *areolatus* - referring to the areolate pileus surface.

Pileus tomentosus, areolatus, lateritius vel rubro-brunneus, ad marginem cinnamomeo-brunneus. Contextus luteus, immutans. *Tubi* aureo-flavi, adnati, immutabilis, *pori* concolores, immutabilis. *Stipes* aequus, sursum rubello-brunneus pruinatus, deorsum aureo-flavus, fibrillosus.

Pileus 10-30 mm diam., convex to plano-convex, tomentose, areolate; Brick Red (8-9E8) or reddish brown (7-8D6-7), Cinnamon Brown (5D5-6) at margin, in some with yellow hues around the margin. *Context* yellow, unchanging after bruising, up to 4 mm thick. *Tubes* adnate, golden yellow, unchanging; *pores* circular, 1-3/mm, golden yellow (3A6), unchanging. *Stipe* 20-40 mm long, 1-3 mm wide, equal, pruinose upper half, minutely fibrillose below, dull reddish brown upper half, golden yellow or sordid yellow lower 1/3. *Basal mycelium* buff yellow. *Spore print* not obtained. *Macro-chemical reactions* not obtained.

Basidiospores 10.4-12.8 × 4 µm (n = 20; 11.4 ± 0.82 × 4; Q_m = 2.85 ± 0.20), fusiform, smooth, golden yellow to greenish golden yellow in KOK. *Basidia* 25.6-32.8 × 9.6-11.2 µm, clavate, 4-sterigmate. *Basidioles* 15.2-24 × 5.6-8 µm, clavate. *Hymenial cystidia* 47.2-64 × 8-11.2 µm, fusoid-ventricose, fusoid-ampullaceous to cylindric. *Pileipellis* a tangled ixotrichoderm of hyphae 3.2-16.8 µm diam., encrusted pigments bright orange in H_2O, diffusing with the application of KOH producing an orange brown or yellowish brown color reaction; contents hyaline or golden yellow or yellowish brown in KOH, brown in Melzer's; some end cells differentiated as *pileocystidia*, these 23.2-40 × 11.2-20 µm, clavate, pyriform or mucronate. *Stipitipellis* hyphae parallel, grayish yellow in KOH, giving rise to clusters of *caulocystidia*, these 40-112 × 5.6-8 µm, cylindric or cylindric-clavate.

Habitat: Gregarious on dead wood or soil, under oaks.

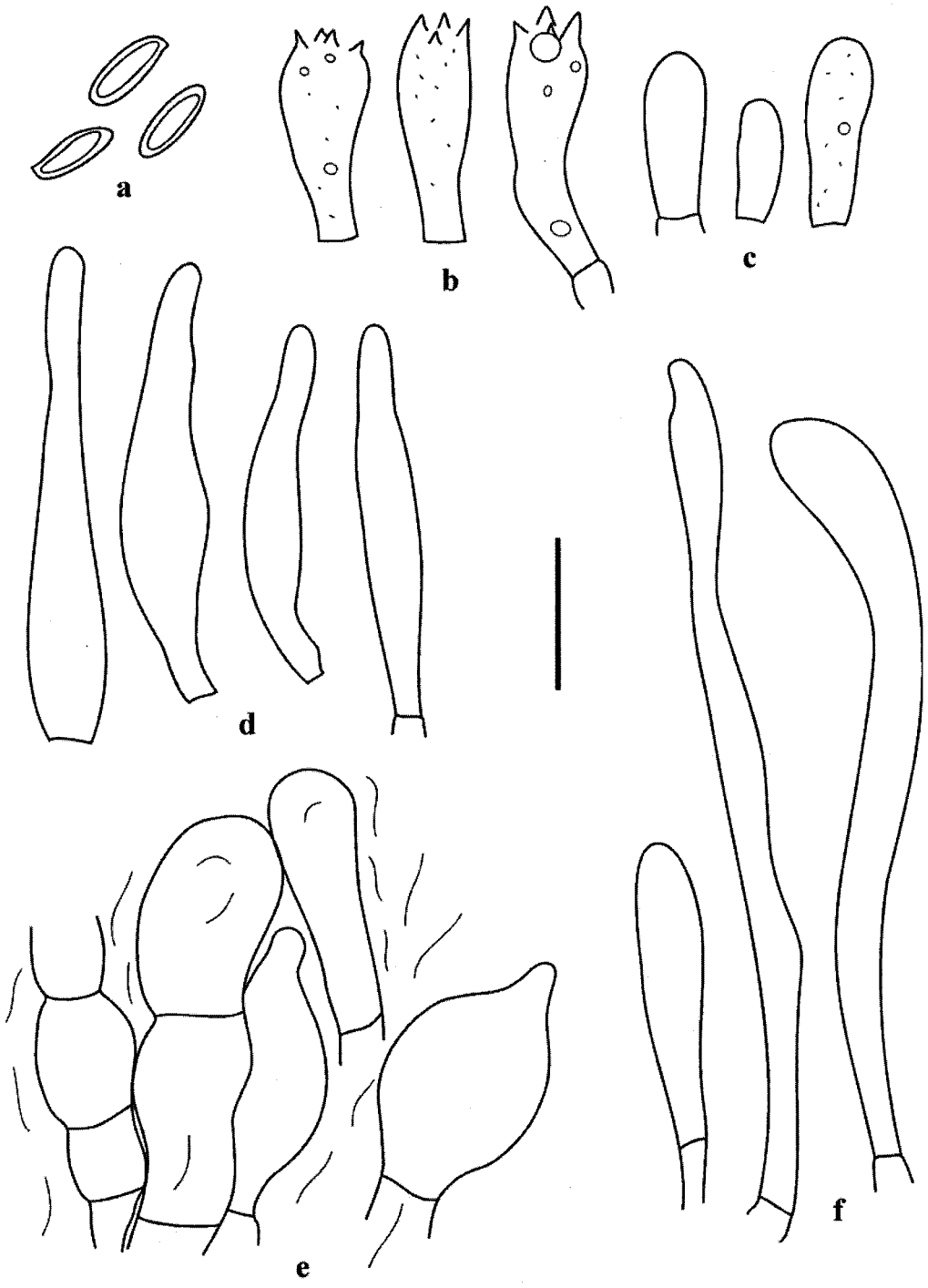


Fig. 51. *Boletus roseoareolatus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** Pileipellis; **f.** Stipitipellis. *TJB 9854*. Scale bar = 20 µm.

Known distribution: Belize.

Material examined: BELIZE. Toledo District: Bladen Nature Reserve, Doyle's Delight, South Trail, 16°29'N, 89°2'W, 1134 m asl, 14 August 2004, *TJB 9854,* BZ 3554 (CORT, **holotype**; CFMR, **isotype**).

Notes: *Boletus roseoareolatus* is characterized by its small basidiocarps, pilei that are tomentose and areolate, red tones over the pileus and stipe, a golden yellow hymenophore and yellow context that does not stain blue; characteristics that place it in Section *Subpruinosi*. Based on the pileus surface and angular pores this species appears to be somewhat xerocomoid but additional data, such as DNA sequences, are needed for a better understanding of its classification. *Boletus roseoareolatus* has the same pileus and stipe color as *B. campestris* and *B. fraternus*, but differs from these species in the absence of blue staining reactions.

28. ***Boletus rugulosiceps*** B. Ortiz, T.J. Baroni & Lodge, **sp. nov.**

(Figs 52, 58)

MycoBank: 511055

Etymology: *rugulosi* - wrinkled; *ceps* - head; for the wrinkled pileus surface.

Pileus minute rugulosus, rubello-brunneus. *Contextus* flavus, immutans. *Tubi* aureo-flavi, adnati, immutabilis, *pori* concolores, immutabilis. *Stipes* aequus, teres, glaber, sursum obscure rhabarbarinus, deorsum ochraceo-flavus, intus vivide luteus.

Pileus 5-8 mm diam., convex, smooth, minutely rugulose, deep reddish brown (8-9E-F7-8); margin decurved. *Context* deep yellow, not bruising blue. *Tubes* adnate, deep golden yellow (4A5), not bruising blue; *pores* circular to angular, 2-3/mm, golden yellow (4A5), not bruising blue. *Stipe* 15-20 mm long, 1-2 mm wide, equal, terete, smooth, glabrous, dull rhubarb red above, ochre yellow at base. *Context* deep yellow. *Basal mycelium* white. *Spore print* not obtained. *Macro-chemical reactions* not obtained.

Basidiospores 9.6-12 × 3.2-4 µm (n = 20; 10.68 ± 1.08 × 3.6 ± 0.41; Q_m = 3.00 ± 0.39), fusiform, smooth, yellow with dark brown wall in Melzer's. *Basidia* 31.2-33.6 × 10.4 µm, clavate to cylindric-clavate, 4-sterigmate. *Basidioles* 16.8-28 × 6.4-8.8 µm, clavate. *Pleurocystidia* 32-40.8 × 6.4-9.6 µm, fusoid-ventricose, fusoid. *Cheilocystidia* 24.8-47.2 × 6.4-8 µm, fusoid-ventricose, fusoid-ampullaceous. *Pileipellis* a palisade trichodermium of erect hyphae 5.6-16.8 µm diam., encrusted pigments orange brown to reddish brown in H_2O, diffusing very quickly with the application of KOH, producing a reddish brown or pale red color reaction; contents golden yellow in KOH, yellowish brown in Melzer's; end cells 12-67.2 × 8.8-16 µm, subisodiametric, subelongated to clavate. *Stipitipellis* hyphae 3.2-17.6 µm diam., parallel, interwoven, in some areas somewhat gelatinous, some multi-septate, hyaline to

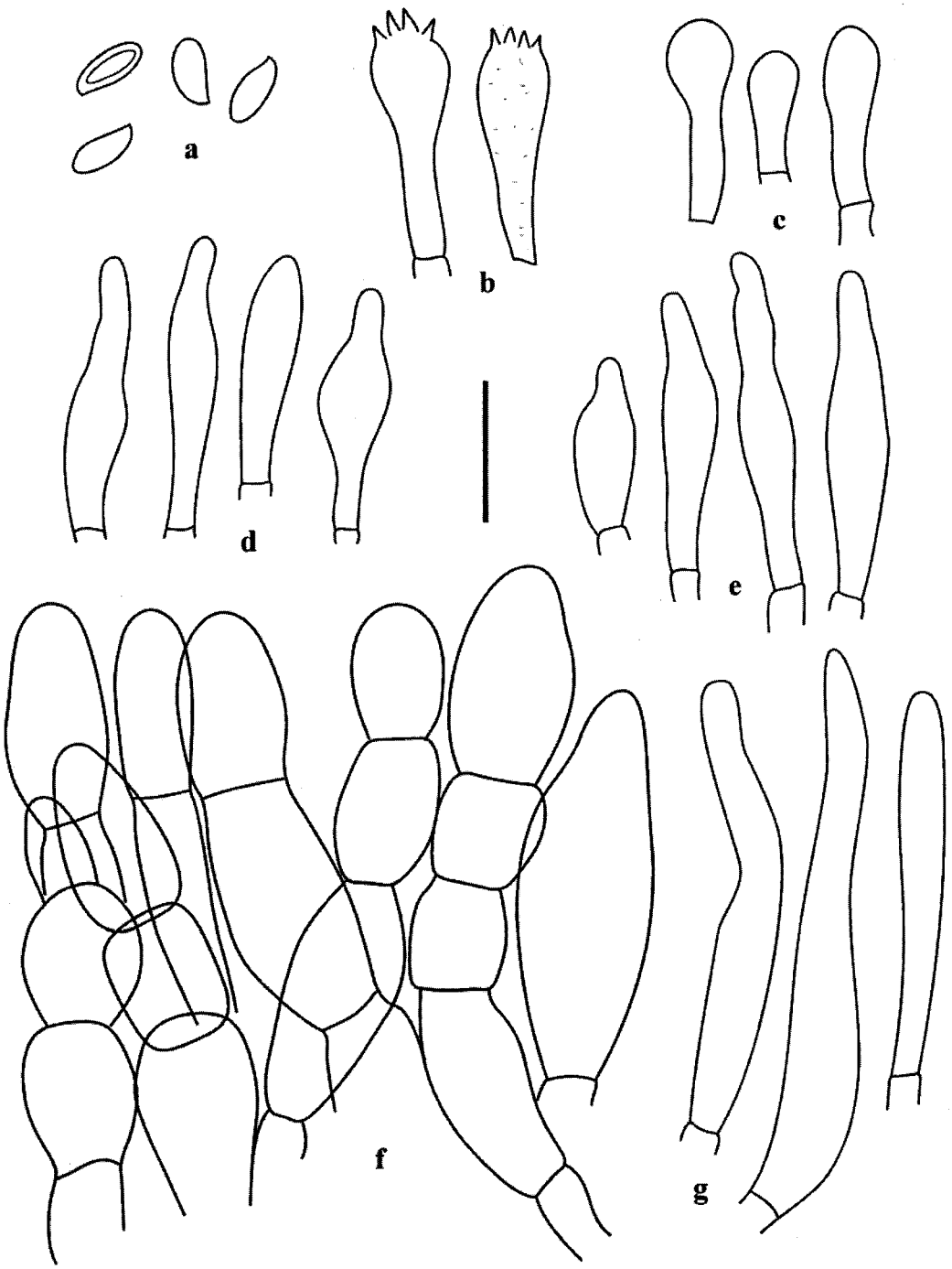


Fig. 52. *Boletus rugulosiceps* . **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Pileipellis; **g.** End-cells of stipitipellis. *TJB 9833.* Scale bar = 20 µm.

very pale yellowish gray in KOH, yellow in Melzer's; end cells mainly cylindrical of 54.4-78.4 × 6.4-10.4 µm.

Habitat: Gregarious over a root, under mixed tropical hardwoods.

Known distribution: Belize.

Material examined: BELIZE. Toledo District: Bladen Nature, Doyle's Delight, East Trail, 16°29'N, 89°2'W, 1070 m asl, 12 August 2004, *TJB 9833*, BZ 3533 (CFMR, **holotype**; CORT, **isotype**).

Notes: *Boletus rugulosiceps* is distinguished by its minute basidiocarp, the rugulose reddish brown pileus, smooth stipe and the non-cyanescent hymenophore and context and the pileipellis as a palisade trichodermium. Some of these characteristics place it under Section *Subpruinosi*, but it is not similar to any described species in that section.

29. ***Boletus variipes var. fagicola*** A.H. Sm. & Thiers, Boletes of Michigan, p. 370. Pl. 146 (1971). (Figs 59, 65)

Pileus 61-82 mm diam., convex to plane-convex, felty, pruinose in some areas, viscid when wet, Clay Color (5D5), Cinnamon (5C4) or Natal Brown (7F6) when mature, youngest ones dark brown or deep reddish brown; margin decurved to plane. *Context* soft, white, not bruising, 6-10 mm thick at center, 4-6 mm at margin; wormhole color Pale Pinkish Buff (5B3). *Odor* not distinctive to bread-like. *Taste* not distinctive to mild. *Tubes* adnexed, shallowly depressed near stipe, 7-9 mm long, pale Sulphur Yellow (3B5) or greenish yellow (3B5), not bruising; *pores* circular, 1-2/mm, Olive Yellow (2C5), pale yellow green when stuffed, some reddish brown with age. *Stipe* 58-80 mm long, 13-15 mm wide at apex, 14-18 mm at middle, 12-15 mm at base, equal or tapered at base or slightly ventricose, strongly to moderately reticulate at apex, finely reticulate below; ground color yellow at apex, Clay Color (5D5) to Natal Brown (7F6) below; reticulum white or whitish gray at apex or overall or Hair Brown (5E5) below; not bruising. *Context* fibrous, white, not bruising. *Basal mycelium* white. *Spore print* Grayish Olive (4E4) to olive or olive brown. *Macro-chemical reactions* not obtained.

Basidiospores 10.4-13.6 (-15.2) × 4-4.8 µm (n = 20; 12.66 ± 1.27 × 4.66 ± 0.31; Q_m = 2.64 ± 0.31), ellipsoid-fusiform, yellowish brown with darker wall in KOH. *Basidia* 23.2-25.6 × 9.6 µm, clavate, (2-) 4-sterigmate. *Basidioles* 13.6-23.2 × 5.6-9.6 µm, clavate. *Hymenial cystidia* 44-52 × 6.4-10 µm, cylindric-fusoid, present mainly at the sides. *Pileipellis* an entangled trichodermium of erect hyphae 3.2-17.6 µm diam., branched, hyaline or grayish yellow in KOH, grayish yellow to yellow in Melzer's; end cells 29.6-69.6 × 6.4-9.6 µm, cylindrical to subfusoid, few with a subcapitate apex, some with pale grayish yellow granular contents in KOH. *Stipitipellis* hyphae 4-17.6 µm diam., parallel to interwoven, subgelatinous in some areas, hyaline in KOH.

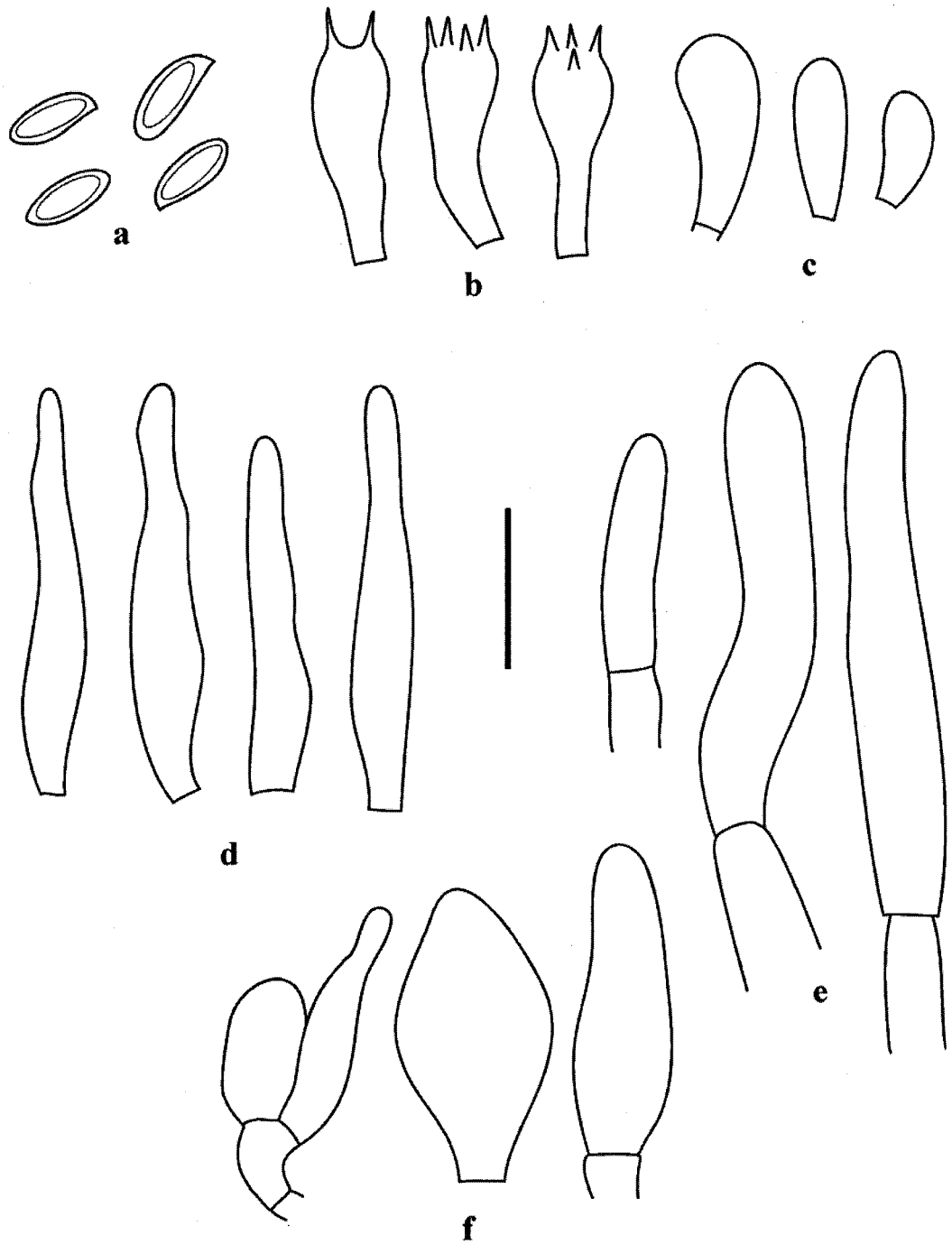


Fig. 59. *Boletus variipes* var. *fagicola*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** End-cells of pileipellis; **f.** Caulocystidia. *BOS 325*. Scale bar = 20 μm.

Caulocystidia 16.8-37.6 × 6.4-17.6 µm, in clusters, clavate, rostrate-ventricose or fusoid-ventricose; *dermatobasidia* present.

Habitat: Gregarious under *Quercus peduncularis*, *Quercus* spp. and *Pinus caribaea*.

Known distribution: Michigan and Mexico in North America; Belize and Costa Rica in Central America.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 12 October 2003, *BOS 606*, BZ 3159 (BRH, CFMR). Cayo District: Mountain Pine Ridge Forest Reserve, Macal River, Guacamayo Bridge at the oak stand above river, 16°53'16.2"N, 89°2'22.2"W, 594 m asl, 5 October 2002, *BOS 325*, BZ 1674 (BRH, CFMR); *TJB 9323*, BZ 2043 (BRH, CORT, CFMR).

Notes: *Boletus variipes* var. *fagicola* can be distinguished by the concolorous pileus and stipe that are dark brown when young, fading to paler brown with age, a pallid reticulum and unchanging context (not bluing). These collections are similar to those described by Smith and Thiers (1971) though they reported longer basidiospores (13-16 µm vs. 10.4-13.6 µm); a description of pleurocystidia is included which was not mentioned in the original description.

30. ***Boletus vermiculosus*** Peck, Ann. Rep. N. Y. State Cabinet 23: 130 (1873). (Figs 60, 66)

Pileus 27-138 mm diam., broadly convex then convex, velvety or finely felty, becoming rimulose at center, slightly shiny, not viscid, Vandyke Brown (7F3-4), Warm Sepia (7F5-6) or Prout's Brown (7F4), becoming Sayal Brown (6D5), darkening when bruised, reddish brown in KOH, brown in NH_4OH; worm hole color reddish brown; margin inrolled to decurved. *Context* soft, solid, pale yellow bruising dark blue, then becoming Plumbeous (20F3) or grayish green, pale orange in KOH and NH_4OH; 7-22 mm thick at center, 2-5 mm at margin. *Odor* mild. *Taste* mild. *Tubes* adnexed or adnate, 1-9 mm long, Sulfur Yellow (2A5), bruising blue, orange brown in KOH, negative in NH_4OH; *pores* angular, 3/mm, Cinnamon (5C4) to Amber (7E8) when closed, then Mars Brown (7F8) or reddish brown, becoming paler (yellowish brown) with time, bruising dark blue. *Stipe* 24-73 mm long, 10-20 mm wide at apex, 18-30 mm at middle, 9-18 mm at base, ventricose, smooth to finely pruinose or felty; ground color Sulfur Yellow (2A5) becoming Sayal Brown (6D5) from middle to base, with red to reddish brown areas at base; bruising blue, orange yellow in KOH, negative in NH_4OH. *Context* soft to fibrous, hard at base, white to Pale Horn Color (4B3), yellow near apex, becoming reddish brown in some areas, bruising blue, yellow in KOH, negative in NH_4OH. *Spore print* not obtained.

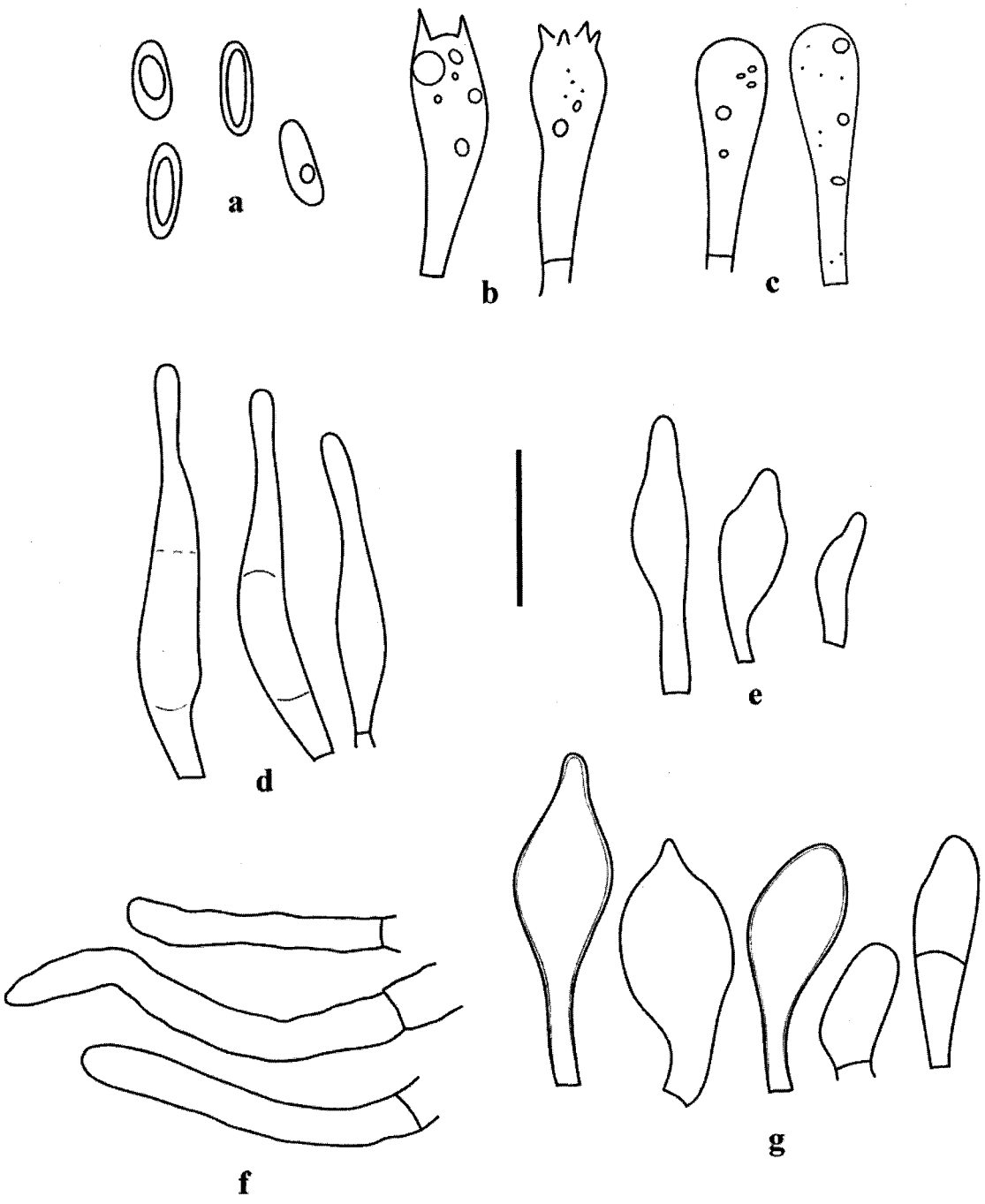


Fig. 60. *Boletus vermiculosus.* **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 454.* Scale bar = 20 µm.

Basidiospores 9.6-14.4 × 3.2-4.8 µm (n = 20; 11.8 ± 1.51 × 3.8 ± 0.57; Q_m = 3.15 ± 0.54), fusiform, subcylindrical, yellowish green with brown wall in KOH, orange brown with dark brown wall in Melzer's, some dextrinoid. *Basidia* 17.6-29.6 × 8.8 µm, clavate, 4-sterigmate. *Basidioles* 16.8-32.8 × 4.8-8.8 µm, clavate. *Pleurocystidia* 32-53.6 × 4-7.2 µm, fusoid-ampullaceous, fusoid-ventricose, some with yellow contents in KOH. *Cheilocystidia* 16.8-35.2 × 4-8 µm, fusoid, fusoid-ventricose. *Pileipellis* a loosely tangled layer of repent hyphae 2.4-16 µm diam., encrusted or embedded in a gelatinous layer; contents pale grayish yellow or yellow in KOH, yellow or dextrinoid in Melzer's; end cells 26.4-49.6 × 4.8-5.6 µm, cylindrical. *Stipitipellis* hyphae 2.4-8.8 µm diam., interwoven, gelatinous in some areas, hyaline or grayish yellow in KOH. *Caulocystidia* 15.2-41.6 × 7.2-13.6 µm, versiform, clavate, ventricose, ventricose mucronate, ventricose-rostrate, some thick-walled, hyaline in KOH.

Habitat: Gregarious under *Quercus* spp.

Known distribution: Eastern Canada to Georgia, west to Michigan and south to Mexico in North America; Belize and Costa Rica in Central America.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, near Forestry Station cabins, 16°58'23"N, 89°59'39"W, 450 m asl, 23 November 2002, *BOS 454*, BZ 2381 (BRH, CFMR); Five Sisters Lodge, near fork in entrance road to Lodge, 17°2'20.2"N, 88°58'16.2"W, 432 m asl, 15 October 2002, *TJB 9408*, BZ 2128 (BRH, CORT, CFMR).

Notes: This collection is characterized by the reddish brown color of the pores, pileus and stipe surfaces, with the pileus and pores becoming paler with age, and by the change to blue after bruising in most parts. It differs from *B. vermiculosus* sensu Smith & Thiers (1971) by the presence of reddish brown stains near the stipe base, narrower cystidia (4-6.4 µm vs. 9-16 µm) and the contents of the caulocystidia that are hyaline rather than yellow. This collection agrees with those described by Halling and Mueller (2005) from Costa Rica, although their collections had broader basidiospores (4.9-5.6 µm vs. 3.2-4.8 µm). *Boletus vermiculosus* is related to *B. subgraveolens* and *B. vermiculosoides* in Subsection *Luridi* of Smith and Thiers (1971). *Boletus subgraveolens* resembles our collection in having red stains on the stipe, but it has a paler pileus that is yellowish brown instead of reddish brown, and the end cells of the pileipellis are tapered rather than rounded at apex. *Boletus vermiculosoides* differs in having a bright yellow to snuff brown rather than pink or reddish brown pileus, the absence of red stains on the stipe and the tips on the end cells of the pileipellis are merely obtuse. *Boletus brunneopanoides* has angular pores, a non-cyanescent stipe surface and somewhat shorter basidiospores (8.8-12.8 µm vs. 11-15 µm). Further comparisons using molecular data are necessary to determine if there is congruence among the molecular and morphological characters of the species mentioned above.

Figs 7-12. 7. *Austroboletus gracilis* var. *gracilis, BOS 496*; **8.** *A. subflavidus, DJL-BZ-27*; **9.** *Boletellus belizensis, TJB 9128*; **10.** *B. coccineus* var. *coccineus, BOS 197*; **11.** *B. coccineus* var. *amarus, BOS 244*; **12.** *B. cubensis, TJB 9954* . Scale bar: 7, 9, 11-12 = 10 mm; 8 = 5 mm; 10 = 30 mm.

Figs 19-24. 19. *Boletellus domingensis, DJL-DR-29*; **20.** *B. singerii, BOS 468*; **21.** *Boletus aureissimus, BOS 353*; **22.** *B. auripes, TJB 9321*; **23.** *B.* cf. *auriporus, BOS 374*; **24.** *B. brunneopanoides, BOS 389*. Scale bar: 19, 21-22 = 15 mm; 20, 23-24 = 30 mm.

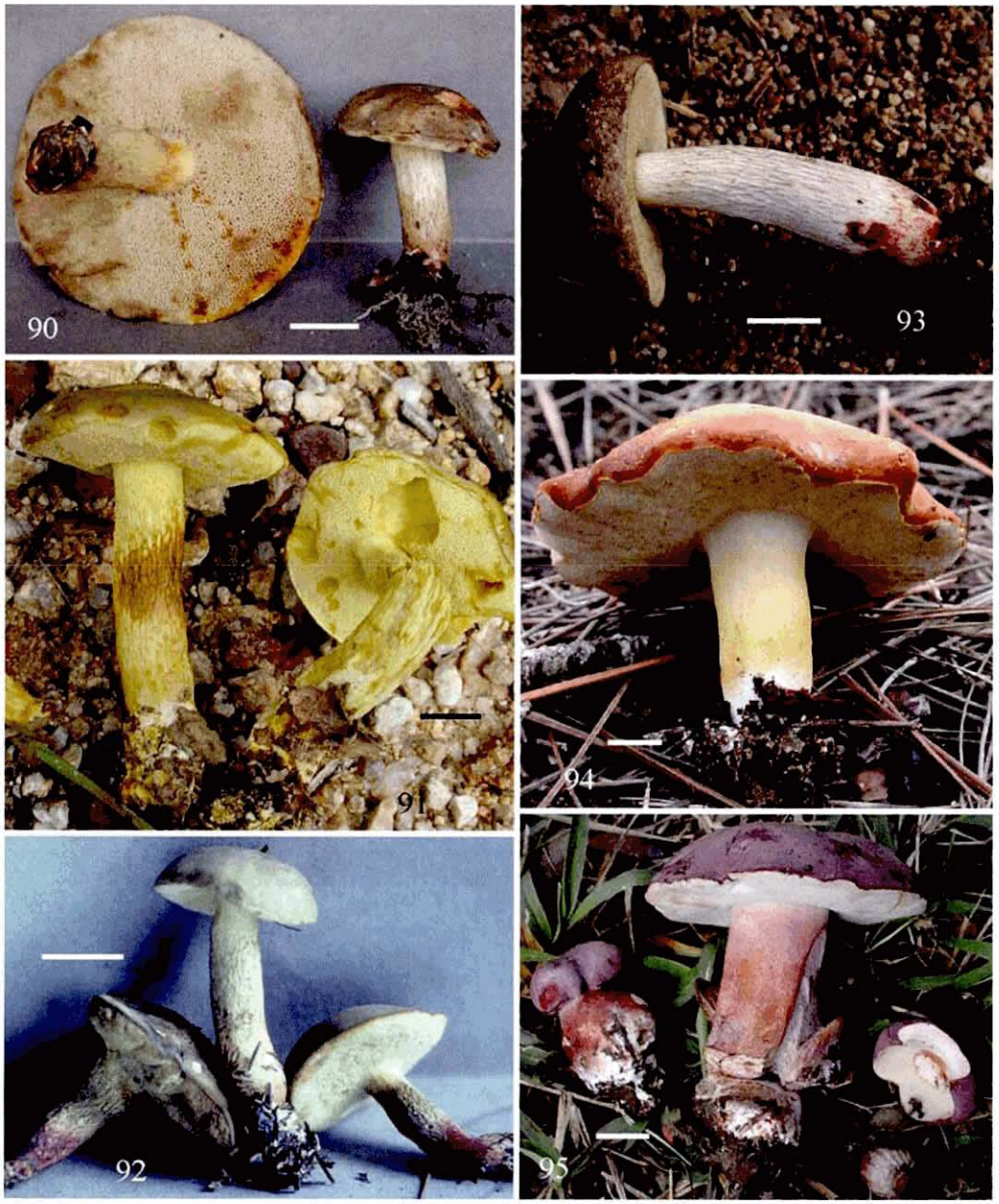
Figs 30-35. 30-31. *Boletus brunneotomentosus, BOS 485*; **32.** *B.* cf. *caribaeus, BOS 600*; **33.** *B. dupainii, BOS 465*; **34.** *B. firmus, BOS 372*; **35.** *B. floridanus, BOS 326*. Scale bar: 30-31 = 30 mm; 32-35 = 20 mm.

Figs 41-46. 41. *Boletus guatemalensis, BOS 354*; **42.** *B. hypocarycinus, DJL-BZ-30*; **43.** *B. inedulis, BOS 363*; **44-45.** *B. mahoganicoloroides, BOS 322*; **46.** *B. neotropicus, TJB 9821.* Scale bar: 41-42, 46 = 15 mm; 43-44 = 30 mm.

Figs 53-58. 53. *Boletus occidentalis, TJB 9769*; **54.** *B. pallidus, TJB 9322*; **55.** *B. projectelloides, TJB 9385*; **56.** *B. pseudofrostii, BOS 266*; **57.** *B. roseoareolatus, TJB 9854*; **58.** *B. rugulosiceps , TJB 9833*. Scale bar: 53 = 50 mm; 54 = 20 mm; 55, 57 = 10 mm; 56 = 8 mm; 58 = 5 mm.

Figs 65-70. 65. *Boletus variipes* var. *fagicola, BOS 325*; **66.** *B. vermiculosus, BOS 454*; **67.** *Fistulinella conica* var. *conica, BOS 356*; **68.** *Heimioporus ivoryi, BOS 474*; **69.** *Leccinum* cf. *holopus* var. *americanum, BOS 455*; **70.** *L.* cf. *rugosiceps, BOS 328*. Scale bar: 65-67, 69-70 = 20 mm; 68 = 30 mm.

Figs 77-83. 77-78. *Leccinum violaceotinctum, BOS 327*; **79.** *Phylloporus boletinoides, TJB 9681*; **80-81.** *P. scabripes, TJB 9709*; **82.** *Pulveroboletus auriflammeus, BOS 384*; **83.** *P. ravenelii, BOS 355*. Scale bar: 77, 80 = 20 mm; 79, 81-83 = 10 mm.



Figs 90-95. 90. *Retiboletus griseus, BOS 351*; **91.** *R. ornatipes, BOS 466*; **92.** *R. vinaceipes, DJL-DR-42*; **93**. *R. vinaceipes, BOS 459*; **94.** *Tylopilus ballouii, BOS 481*; **95.** *T. violatinctus, BOS 484*. Scale bar: 90, 92, 94-95 = 20 mm; 91, 93 = 15 mm.

Figs 102-107. 102. *Xerocomus belizensis, TJB 9400*; **103.** *X. olivaceus, TJB 9943*; **104.** *X. pseudoboletinus, DJL-BZ-62*; **105.** *Strobilomyces confusus, BOS 184*; **106.** *S. strobilaceus, BOS 371*; **107.** *Gyroporus castaneus, BOS 472*. Scale bar: 102, 103, 106-107 = 20 mm; 104, 105 = 10 mm.

Figs 114-119. 114. *Gyroporus* cf. *phaeocyanescens, BOS 360*; **115.** *Suillus brevipes, BOS 467*; **116.** *S. decipiens, BOS 375*; **117.** *S. pseudoalbivelatus, BOS 507*; **118.** *S. salmonicolor, BOS 475*; **119.** *S. tomentosus, BOS 536*. Scale bar: 114-115 = 10 mm; 116 = 30 m; 117-119 = 20 mm.

Genus *Fistulinella* Henn.

31. ***Fistulinella conica*** (Ravenel) Pegler & T.W.K. Young **var. *conica***, Trans. Br. Mycol. Soc. 76(1): 140 (1981). (Figs 61, 67)

Synonyms:
Boletus conicus Ravenel, Ann. Mag. Nat. Hist. 12: 430 (1853).
Ceriomyces conicus (Ravenel) Murrill, Mycologia 1(4): 146 (1909)
Tylopilus conicus (Ravenel) Beardslee, Mycologia 26: 253 (1934).
Mucilopilus conicus (Ravenel) Wolfe, Mycotaxon 10: 119. 1979.

Pileus (32-) 53-85 (-93) mm diam., hemispheric, broadly convex, convex to plane, appressed squamose or with flat wooly scales; ground color white with yellow to brownish yellow or greenish brown scales, bruising Buff (4B4) or dark brown or Flesh Ocher (7C5) to Mahogany Red (8D6); scales reddish brown in KOH, negative in NH_4OH; margin decurved, appendiculate. *Context* soft, white, not bruising in some, others bruising Pale Pinkish Buff (5B3) to pale vinaceous, pale yellow to pale brown in KOH, negative in NH_4OH; 10-14 (-18) mm thick at center, (2-) 4-5 mm at margin. *Odor* not distinctive. *Taste* sweet or slightly sour. *Tubes* adnate, 4-12 mm long, white to pale grayish vinaceous, darkening when bruised; *pores* circular, 1-2/mm, white to pale grayish vinaceous or peach-pinkish, darkening when bruised. *Stipe* 32-55 (-72) mm long, 12-13 (-45) wide mm at apex, 10-12 (-42) mm at middle, 11-17 (-25) mm at base, equal, slightly bulbous, fibrillose at apex, finely felty below; ground color white becoming yellow or pinkish cinnamon in some areas, bruising yellow ochre (mainly at middle); negative in KOH and NH_4OH. *Context* white, some yellow at apex, not bruising, negative in KOH and NH_4OH. *Basal mycelium* white. *Spore print* Sayal Brown (6D5) (pinkish brown).

Basidiospores 12-17.6 × 4-4.8 (-5.6) µm (n = 20; 14.96 ± 1.46 × 4.46 ± 0.48; Q_m = 3.37 ± 0.39), fusiform to cylindrical, pale greenish yellow in KOH. *Basidia* 25.6-29.6 (31.2) × (8.8-) 9.6-11.2 µm, clavate, 4-sterigmate. *Basidioles* 21.6-28 × 8-9.6 µm, clavate. *Pleurocystidia* (36-) 45.6-60.8 × 6.4-7.2 µm, cylindric-fusoid, fusoid-ampullaceous. *Pileipellis* a tangled layer of elongated repent and erect hyphae 3.2-10.4 µm diam., branched, gelatinous in some areas, hyaline in KOH, some dextrinoid in Melzer's; end cells cylindrical. *Stipitipellis* hyphae 2.4-10.4 (-12.8) µm diam., parallel, interwoven, gelatinous or encrusted in some areas, hyaline or with pale grayish yellow contents in KOH; end cells cylindrical, 3.2-8 µm diam.

Habitat: Gregarious on soil under *Pinus caribaea* and *Quercus* spp.

Known distribution: *Fistulinella conica* is distributed from North Carolina south to Florida in North America; the variety *conica* has been reported from

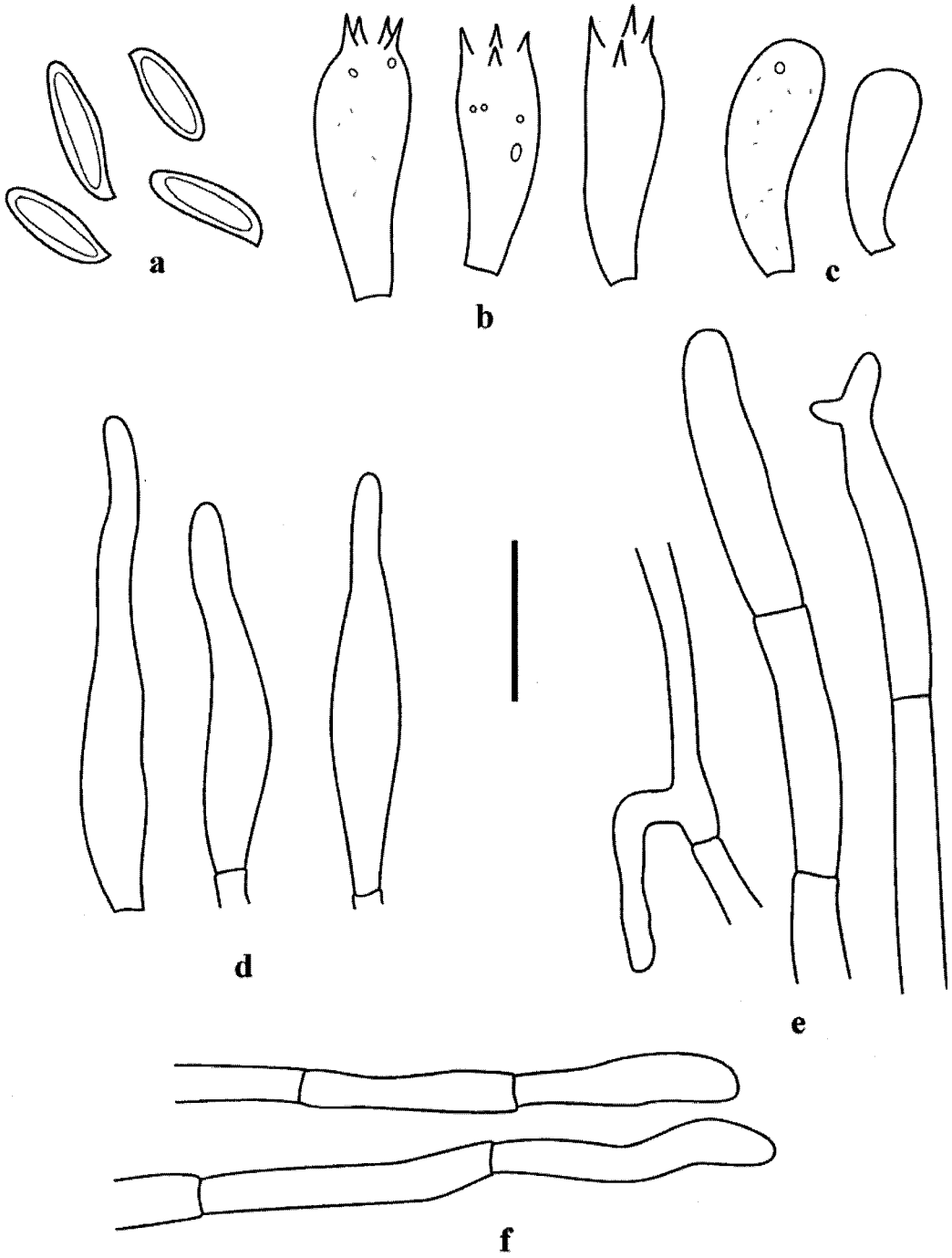


Fig. 61. *Fistulinella conica* var. *conica*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** End-cells of pileipellis; **f.** End-cells of stipitipellis. *BOS 356*. Scale bar = 20 µm.

Mexico in North America and Belize in Central America (first report of this variety in Central America).

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, Forestry Station camp ground, 16°58'22.9"N, 88°59'44"W, 456 m asl, 13 October 2002, *BOS 356,* BZ 1705 (BRH, CFMR); Douglas da Silva, swamp near British Military Camp, 16°58'8.9"N, 88°59'38.4"W, 450 m asl, 9 January 2002, *TJB 9207*, BZ 757 (BRH, CORT), *TJB 9208*, BZ 758 (BRH, CORT); 4 October 2002, *BOS 321*, BZ 1670 (BRH, CFMR); 13 October 2002, *TJB 9390*, BZ 2110 (BRH, CORT); 3 October 2003, *REH 8510*, BZ 3290 (BRH, NY); Five Sister Lodge, near Lodge, 17°2'16"N, 88°59'7.8"W, 387 m asl, 30 November 2002, *BOS 480*, BZ 2408 (BRH, CFMR).

Notes: *Fistulinella conica* var. *conica* is distinguished by its pulvinate to convex or broadly conical pileus, depressed tubes, glabrous stipe and a negative reaction to NH_4OH on the context. *Fistulinella conica* var. *belizensis* Singer & M.H. Ivory (described on the basis of a single collection by Ivory, Augustine Forest Station 17 July 1976) is separated by the distinct umbo on a conical convex pileus, adnate tubes, finely tomentose to scurfy stipe, a context that turns red with the application of NH_4OH and by the shorter pleurocystidia (22-40 μm vs. 31-68 μm). Our collections represent *F. conica* var. *conica* since they agree with the concept of this variety in Singer *et al.* (1991), although most of our collections have adnate rather than depressed tubes and a fibrillose rather than a glabrous stipe. Even though we collected several times over 4 years in the type area for *F. conica* var. *belizensis* we were unable to find specimens representing this taxon.

Genus *Heimioporus* E. Horak

32. ***Heimioporus ivoryi*** (Singer) E. Horak, Sydowia 56: 238 (2004)

(Figs 62, 68)

Synonyms:

Boletellus ivoryi Singer in Singer *et al.*, Beih. Nova Hedwigia 77: 163 (1983).

Heimiella ivoryi (Singer) Watling, Notes Roy. Bot. Gard. Edinburgh 46: 420 (1990).

Pileus 91-93 mm broad, convex, felty, viscid when wet; Geranium Pink (10A7) or Coral Red (9A7), darkening after bruising, Verona Brown (6E7) in KOH, negative in NH_4OH; margin decurved, forming a sterile band. *Context* soft, Sulfur Yellow (2A5), bruising Spectrum Yellow (3A8), pale greenish blue around wormholes, Raw Umber (5E5-6) in KOH, negative in NH_4OH; 11 mm thick at center, 4 mm at margin; worm holes brown to reddish brown. *Tubes* adnate with long decurrent tooth, 11-15 mm long, yellow to Olive Yellow (2C5), Verona Brown (6E7) in KOH, negative in NH_4OH; *pores* irregular to angular, 1-1.5 × 0.5-1 mm, yellow, bruising Olive Yellow (2C5), becoming reddish brown with age. *Stipe* 132-137 mm long, 16-17 mm wide at apex, 17-29 mm at middle, 20-30 mm at base, tapered at apex; moderately reticulate upper half, felty overall; ground color Sulfur Yellow (2A5) at apex, Flesh Color

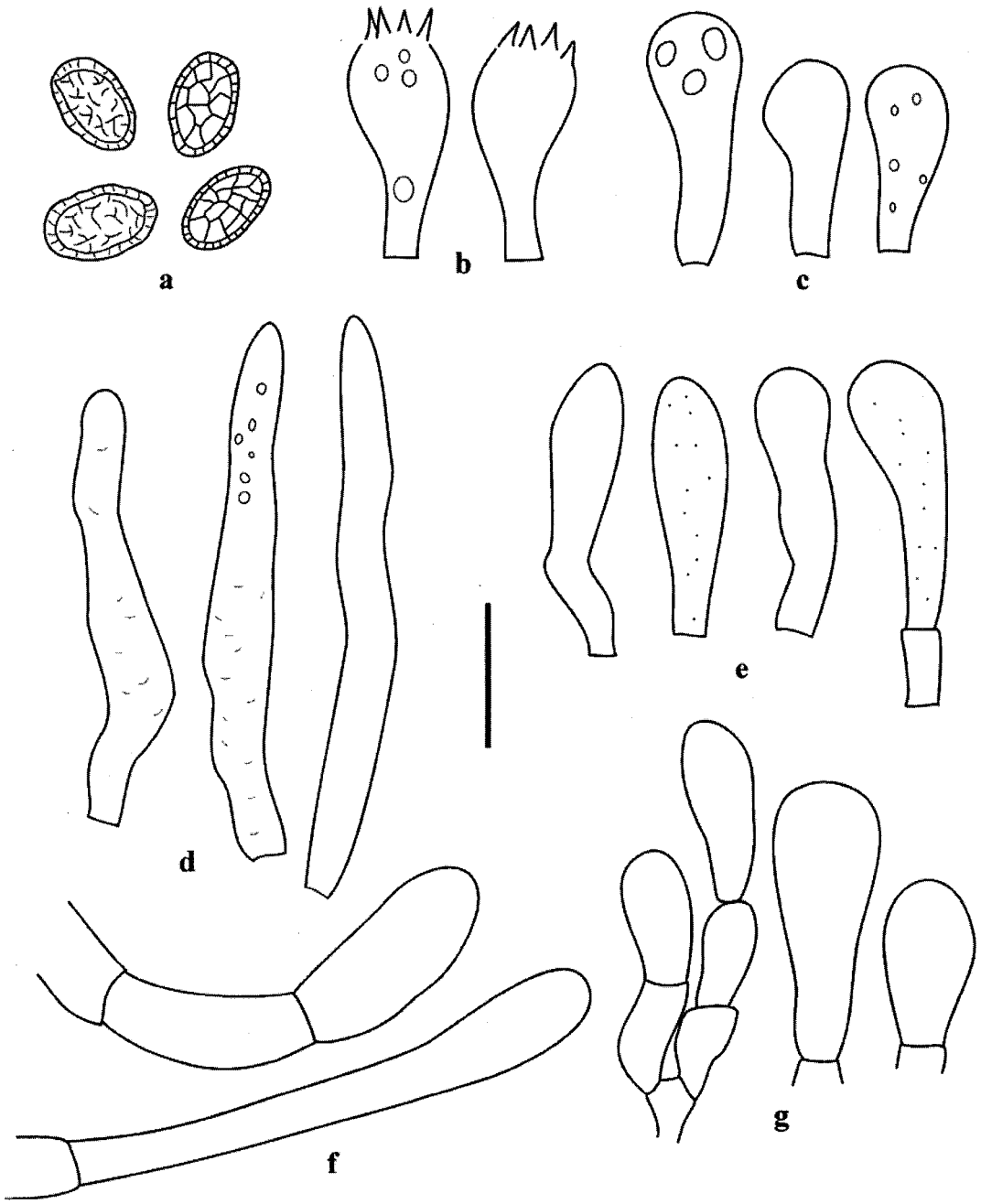


Fig. 62. *Heimioporus ivoryi.* **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 474.* Scale bar = 20 µm.

(7B3) below; reticulum and fibrils pale pink to Geranium Pink (10A7); bruising Mahogany Red (8D6) mainly on the lower half, yellow in KOH, negative in NH_4OH. *Context* fibrous, Sulfur Yellow (2A5), bruising Spectrum Yellow (3A8), becoming Tawny Olive (5C4) or purple in some areas, negative in KOH, and NH_4OH. *Basal mycelium* white. *Spore print* not obtained.

Basidiospores 9.6-15.2 (-16) × (7.2-) 8-9.6 µm (n = 20; 13.4 ± 1.76 × 8.4 ± 0.63; Q_m = 1.60 ± 0.13), ellipsoid to rounded at one end, alveolate-reticulate, golden yellow to bronze in KOH, bright orange red to dextrinoid in Melzer's. *Basidia* 28.8-29.6 (-42.4) × 12-13.6 µm, clavate, 4-sterigmate. *Basidioles* 22.4-33.6 × 11.2-12 µm, clavate. *Pleurocystidia* (41.6-) 60-78.4 × 5.6-8.8 µm, cylindrical-ampullaceous. *Cheilocystidia* 26.4-41.6 (-50.4) × (6.4-) 8-12 µm, mostly clavate, some fusoid-ampullaceous or fusoid. *Pileipellis* a tangled layer of repent to suberect hyphae (3.2-) 4-17.6 µm diam., hyaline or with bright yellow contents in KOH; end cells 29.6-72 × 9.6-12.8 µm, clavate, broadly clavate or cylindric-clavate, some inflated, some moderately thick-walled. *Stipitipellis* hyphae 4-13.6 µm diam., parallel, hyaline in KOH, dextrinoid in Melzer's, giving rise to clusters of *caulocystidia*; these (17.6-) 21.6-33.6 × 8.8-13.6 µm, clavate, broadly clavate or obpyriform.

Habitat: Solitary under *Quercus peduncularis*.

Known distribution: Mexico in North America; Belize and Costa Rica in Central America.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Five Sisters Lodge, lower Nature Trail, under *Quercus peduncularis*, 17°2'16"N, 88°59'8"W, 308 m asl, 9 August 2001, *ASM 9385*, BZ 184 (CFMR); same general area, approx. 2/3 way down entrance road to Five Sister's Lodge, 17°2'14.6"N, 88°58'42.5"W, 335 m asl, 15 October 2002, *TJB 9409*, BZ 2129 (BRH, CORT); near fork in entrance road to Lodge, 17°2'20.2"N, 88°58'16.2"W, 432 m asl, 29 November 2002, *BOS 474,* BZ 2402 (CFMR); Douglas da Silva, Forestry Station, 16°58'23"N, 88°59'37"W, 450 m asl, 1 December 2002, *BOS 486*, BZ 2414 (BRH, CFMR).

Notes: *Heimioporus ivoryi* is characterized by a coral red pileus, a reticulate stipe and ellipsoid alveolate-reticulate spores. These collections agree very well with the ones described by Singer *et al.* (1992), though our collections have cheilocystidia that are more often clavate than ampullaceous.

Genus *Leccinum* Gray

33. ***Leccinum* cf. *holopus* var. *americanum*** A.H. Sm. & Thiers, Boletes of Michigan, p. 183. Pl. 80 (1971). (Figs 63, 69)

Pileus 43-81 mm diam., broadly convex then convex, finely felty, viscid when wet, Pale Horn Color (4B3), Pale Pinkish Buff (5B3) at center, bruising slowly Tawny (6-7D7), darkening with age, becoming brown with olive brown tints, pale brown in KOH, negative in NH_4OH; margin decurved. *Context* white

bruising Vinaceous (11B5) to Deep Vinaceous (11C5), negative in KOH and NH_4OH; 8 mm thick at center, 2 mm at margin. *Odor* not distinctive. *Taste* mild, sweet. *Tubes* adnexed to depressed around stipe, 10 mm long, white becoming grayish brown with time, bruising pale vinaceous, vinaceous in KOH, negative to slightly vinaceous in NH_4OH; *pores* angular, 2/mm, white, bruising pale grayish vinaceous, becoming Tawny Olive (5C4) to Raw Umber (5E5-6). *Stipe* 45 mm long, 9-10 mm wide at apex, 11 mm at middle and 7-8 mm at base, subequal, scabrous; ground color white to Flesh Color (7B3) with reddish brown to black scabers, with pale yellow tones near the greenish blue tints at base; yellow in KOH, negative in NH_4OH. *Context* soft, white, bruising vinaceous at apex, yellow in other areas and becoming green at base, yellow in KOH, negative in NH_4OH; worm hole color dark brown. *Basal mycelium* white. *Spore print* not obtained.

Basidiospores 13.6-20.8 × 4.8-6.4 µm (n = 20; 16.8 ± 2.28 × 5.76 ± 0.56; Q_m = 2.93± 0.38), cylindric-fusoid, yellowish brown in KOH, thick-walled. *Basidia* 22.4-32 × 9.6-11.2 µm, clavate, (2-) 4-sterigmate. *Pleurocystidia* 41.6-62.4 × 10.4-18.4 µm, fusoid-ampullaceous, fusoid-ventricose. *Cheilocystidia* 28-38.4 × 6.4-8.8 µm, fusoid, subfusoid-ventricose. *Pileipellis* a tangled layer of repent hyphae 3.2-16 µm diam., some elongated and inflated, with grayish yellow or yellowish brown contents in KOH, end cells cylindrical or clavate. *Stipitipellis* hyphae 3.2-17.6 µm diam., elongated, interwoven, with gray, grayish yellow or yellowish brown contents in KOH. *Caulocystidia* 20-49.6 × 6.4-16 µm, fusoid, clavate, fusoid ampullaceous, gray or grayish yellow in KOH.

Habitat: Gregarious under *Pinus caribaea* and *Quercus* spp.

Known distribution: *Leccinum holopus* var. *americanum* has been reported from Eastern Canada south to New York and west to Minnesota in North America.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, near Forestry Station cabins, 16°58'23"N, 89°59'39"W, 450 m asl, 23 November 2002, *BOS 455*, BZ 2382 (BRH).

Notes: *Leccinum holopus* var. *americanum* is characterized by a nearly white pileus that becomes vinaceous buff with age, a white pileus context that stains red, black scabers and pale green tones near the stipe base. This collection agrees in most characteristics with those described by Smith and Thiers (1971) for *L. holopus* var. *americanum*. However, in our specimens the pileus becomes brown with age, the pileus context stains vinaceous rather than red, it has yellow colors near the green discolorations at the stipe base and the pleurocystidia are larger (41.6-62.4 × 10.4-18.4 µm vs. 32-46 × 7-12 µm); our material was also collected under pine.

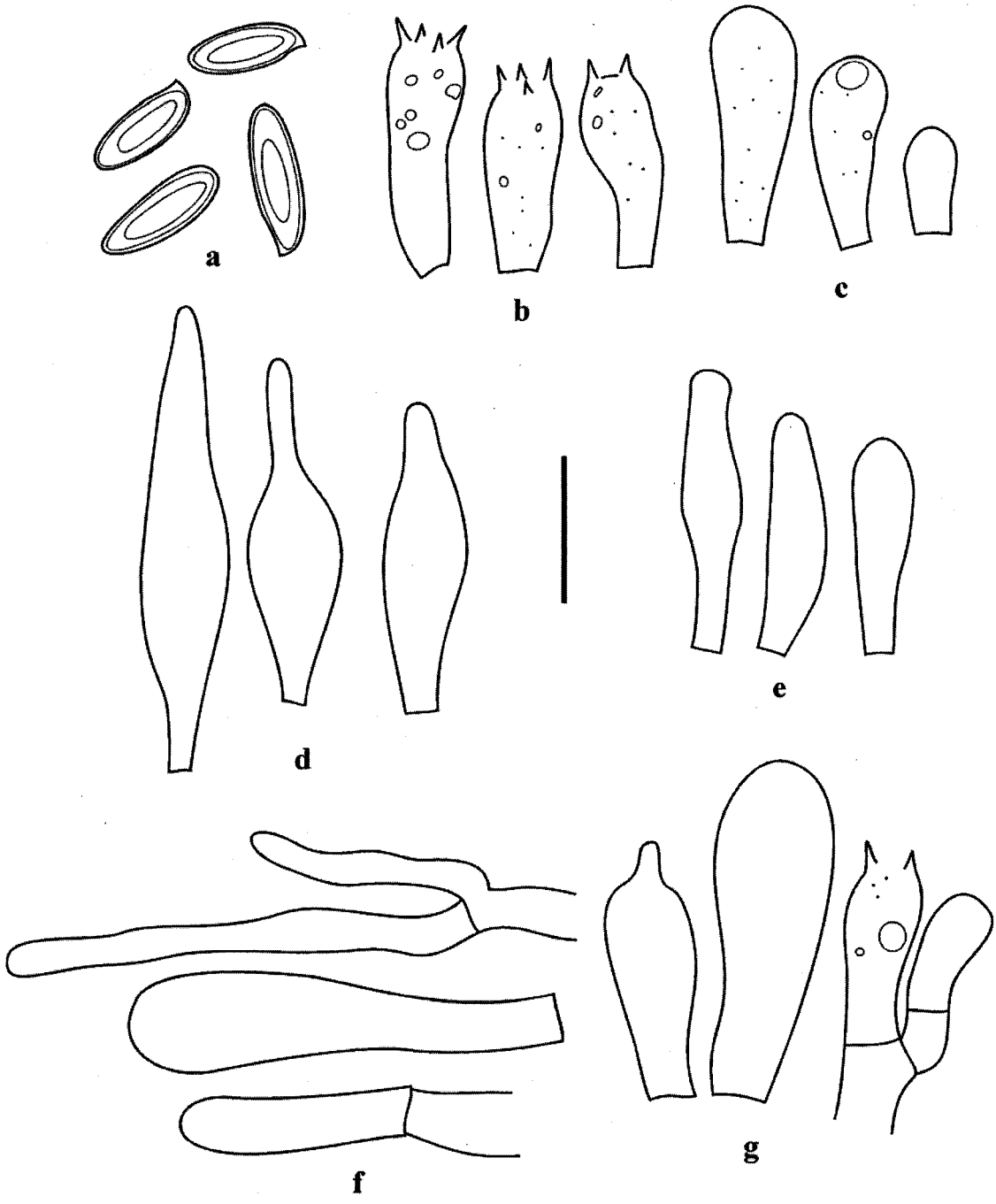


Fig. 63. *Leccinum* cf. *holopus* var. *americanum*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 455*. Scale bar = 20 µm.

34. ***Leccinum* cf. *rugosiceps*** (Peck) Singer, Mycologia 37: 799 (1945).
(Figs 64, 70)

Synonyms:
Boletus rugosiceps Peck, Bull. N.Y. State Museum 94: 20. Pl. Q (6-10) (1904).
Krombholzia rugosiceps (Peck) Singer, Ann. Mycol. 40: 34. (1942).
Krombholziella rugosiceps (Peck) Sutara, Ceská Mykologie 36 (2): 82. 1982.

Pileus 42-66 mm diam., broadly convex then convex, smooth, rivulose or pitted-scrobiculate, slightly or strongly viscid when wet, Natal Brown (7F6) to Raw Umber (5E5-6), Verona Brown (6E7) at margin, not bruising, negative in KOH, NH_4OH and $FeSO_4$; margin decurved. *Context* watery, pale cream (4A3), bruising slowly pale grayish vinaceous, becoming red, orange yellow in KOH, negative in NH_4OH, blue in $FeSO_4$; 7-10 mm thick at center, 3-4 mm at margin. *Odor* not distinctive. *Taste* not distinctive to mild. *Tubes* adnexed, depressed around stipe, some with decurrent tooth, 6-14 mm long, pale yellow becoming pale grayish vinaceous with age, not bruising, orange yellow in KOH, pale brownish yellow in NH_4OH, blue in $FeSO_4$; *pores* circular, 2/mm, pale yellow becoming Straw Yellow (3B4), bruising pale grayish vinaceous, then brown. *Stipe* 42-57 mm long, 12-15 mm wide at apex, 15 mm at middle, 9-10 mm at base, clavate or tapered at base, scabrous; ground color pale Buff (4B4) at apex and base, Light Drab (5D3) at middle with Sayal Brown (6D5) to Mikado Brown (6D4-5) to Brussels Brown scabers; brownish yellow in KOH, pale brown in NH_4OH, dark brown in $FeSO_4$. *Context* soft, solid, pale Cream Color (4A3), bruising yellow becoming pale grayish vinaceous with Plumbeous (20F3) areas near edges, orange yellow in KOH, yellow in NH_4OH, blue in $FeSO_4$. *Basal mycelium* pale yellow. *Spore print* Mars Brown (7F8).

Basidiospores 11.2-15.2 × 4.8-6.4 µm (n = 20; 13.48 ± 1.33 × 5.48 ± 0.47; Q_m = 2.47 ± 0.24), ellipsoid to subfusiform, greenish yellowish brown in KOH. *Basidia* 32-44 × 10.4-11.2 µm, clavate, cylindric-clavate, 4-sterigmate. *Basidioles* 22.4-30.4 × 5.6-8 µm, clavate. *Pleurocystidia* 44-56.8 × 7.2-8.8 µm, fusoid-ampullaceous or cylindric-fusoid. *Cheilocystidia* 25.6-35.2 × 4-4.8 µm, fusoid, cilindric-fusoid. *Pileipellis* a tangled pallisade trichodermium of erect hyphae 4-13.6 µm diam., some thick-walled, hyaline in KOH; end cells 8-16 µm diam., vesiculose or subglobose, some with acute tips, with pale grayish brown or yellowish brown contents in KOH, some brown in Melzer's. *Stipitipellis* hyphae 4-12.8 µm diam., parallel, with some areas interwoven to gelatinous, hyaline or with pale grayish yellow contents in KOH, giving rise to clusters of *caulocystidia*; these 16-35.2 × 5.6-12 µm, cylindrical, ventricose, some mucronate, with grayish brown to pale brown contents in KOH; *dermatobasidia* present, 32.8-44 × 10.4-11.2 µm.

Habitat: Gregarious under *Quercus* spp.

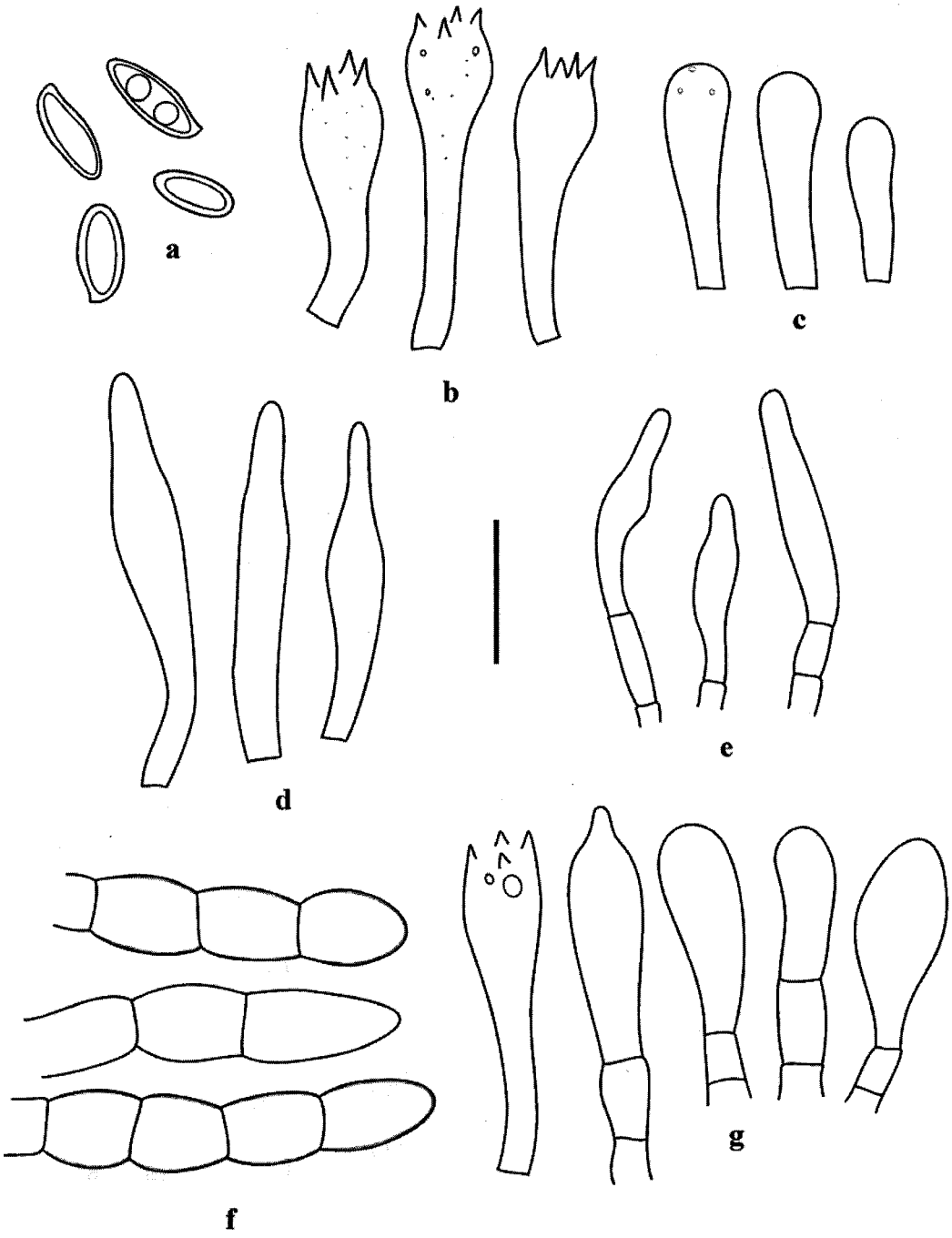


Fig. 64. *Leccinum* cf. *rugosiceps*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia and dermatobasidium. *BOS 328.* Scale bar = 20 μm.

Known distribution: *Leccinum rugosiceps* has been reported from Eastern Canada to Florida, west to Michigan and Mississippi and south to Mexico in North America; Belize and Costa Rica in Central America.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 7 October 2002, *BOS 328,* BZ 1677 (BRH, CFMR).

Notes: *Leccinum rugosiceps* is characterized by brown tones over the pileus and stipe surfaces, a rugulose pileus, a ridged or scabrous stipe with the scabers a moderate brown color at first, a pale yellow hymenophore and the pileipellis hyphae forming a distinctive trichodermial palisade, composed of cellular to subelongated thin-walled elements with rounded or acute tips. Our collection has darker brown pileus and scabers, longer pleurocystidia (44-56.8 µm vs. 33-40 µm) and somewhat smaller basidiospores (11.2-15.2 × 4.8-6.4 µm vs. 14-17 × 4.8-5.2 µm) and caulocystidia (16-35.2 × 5.6-12 µm vs. 39-68 × 6.8-15 µm) than those described by Singer (1947) and Halling and Mueller (2003). In addition our collection also has end-cells in the pileipellis that are thick-walled, a feature not reported for *L. rugosiceps*.

35. ***Leccinum violaceotinctum*** B. Ortiz & T.J. Baroni, **sp. nov.**

(Figs 71, 77-78)

MycoBank: 511056

Etymology: *violaceo* - violet; *tinctus* - tinted; for the violaceous stains in the pileus and stipe context.

Pileus convexus demum applanatus, glutinosus in humide, albidus demum olivaceo-cinereus, turcoisinus tinctus. *Contextus* albus, ubi contusi atroviolaceus vel rubro-brunneus. *Tubi* cremei vel cinereo-brunnei, adnexi, subdecurrentes, *pori* albi, demum albido-cremei. *Stipes* clavato-ventricosus, sursum minute floccosus, deorsum scabrosus, albido-cremeus, turcoisinus tinctus ad basim, intus albidus, fractu violaceo-caeruleus.

Pileus (35-) 36-80 mm diam., broadly convex, convex, or applanate, smooth, strongly viscid when wet, white to Pale Horn Color (4B3) in younger specimens, becoming Pearl Gray (4C1-2) to Olive Gray (4D3) or Cinnamon Brown (5D5-6) to brown near margin, some with a turquoise tint, not bruising, negative to brown in KOH and NH_4OH, blue in $FeSO_4$; margin decurved forming a sterile band. *Context* white, bruising pale grayish vinaceous to dark violet (16F4) to Robin Rufous (7E8) to Walnut Brown (8E5), negative in KOH (in some specimens brown), pale grayish vinaceous to brownish black in NH_4OH, blue in $FeSO_4$; (6-) 7-14 mm thick at center, 3-5 mm at margin. *Odor* not distinctive. *Taste* sweet, mild. *Tubes* adnexed with decurrent tooth, 4-12 mm long, Cream Color (4A3) becoming pale grayish vinaceous to grayish brown, pale brown in KOH, pale grayish vinaceous in NH_4OH, greenish brown in $FeSO_4$; *pores* circular, 2-3/mm, white or whitish cream becoming pale grayish vinaceous then Clay Color (5D5) or yellowish brown. *Stipe* 33-55 (-77)

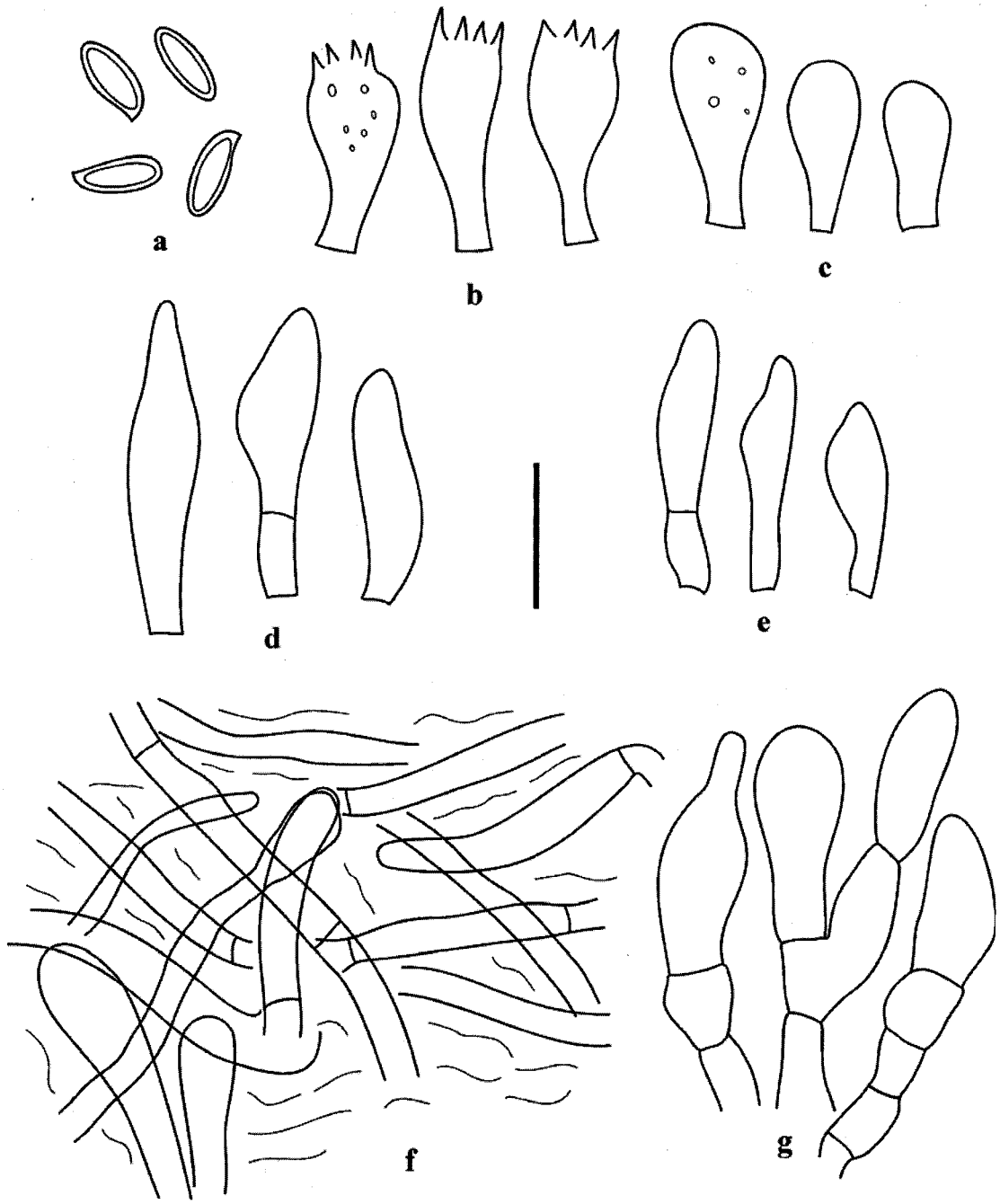


Fig. 71. *Leccinum violaceotinctum.* **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Pileipellis; **g.** Caulocystidia. *BOS 327.* Scale bar = 20 μm.

mm long, 7-17 mm wide at apex, 10-26 mm at middle, 11-24 mm at base, equal, clavate or ventricose, finely floccose upper half, pruinose to scabrous below; ground color whitish cream with Cream Color (4A3) to Sepia (5A1-2) scabers, some with a turquoise area near base; negative in KOH and NH_4OH, blue in $FeSO_4$. *Context* soft, white, bruising pale grayish vinaceous to Plumbeous (20F3) to violet blue to Indigo Blue (20F5) to dark Fuscous (7F4), becoming Turquoise Blue (24A6-7) at base edges, negative in KOH and NH_4OH, blue in $FeSO_4$. *Basal mycelium* white, finely cottony. *Spore print* Sayal Brown (6D5).

Basidiospores 12-13.6 (-16) × 4-4.8 (-5.6) µm (n = 20; 12.6 ± 0.57 × 4.52 ± 0.39; Q_m = 2.81 ± 0.24), fusiform, smooth, yellowish brown to orange brown with brown wall in KOH, dextrinoid in Melzer's. *Basidia* 24-33.6 × 4-13.6 µm, clavate, 4-sterigmate. *Basidioles* 14.4-30.4 × 4-12 µm, clavate. *Pleurocystidia* 24-52 × (6.4-) 7.2-8.8 (-10.2) µm, fusoid, fusoid-ampullaceous. *Cheilocystidia* 20-38.4 × 4.8-7.2 µm, fusoid or fusoid ventricose. *Pileipellis* a tangled layer of repent hyphae 2.4-13.6 µm diam., subgelatinous, encrusted pigments golden yellow or yellowish brown or brown in H_2O, with little diffusion on application of KOH and not producing color reactions; hyaline or with pale grayish yellowish brown contents in KOH; dextrinoid in Melzer's; end cells cylindrical. *Stipitipellis* hyphae 2.4-12.8 µm diam., interwoven, with grayish yellow to golden yellow contents in KOH, giving rise to clusters of *caulocystidia*; these 20.8-45.6 × 7.2-11.2 µm, versiform, clavate, fusoid or ampullaceous, hyaline in KOH, yellow in Melzer's; *dermatobasidia* present.

Habitat: Gregarious under *Pinus caribaea* and *Quercus* spp.

Known distribution: Belize.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at the Tropical Education Center, 17°21'27"N, 88°32'30"W, 30 m asl, 6 October 2002, *BOS 327,* BZ 1676 (CMFR, **holotype**; BRH, **isotype**); Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, , 7 October 2002, *TJB 9338*, BZ 2058 (BRH, CORT); 14 October 2003, *BOS 616*, BZ 3169 (BRH, CFMR).

Notes: *Leccinum violaceotinctum* is distinguished by the whitish cream color over the pileus and stipe surfaces that become vinaceous or grayish blue to cinnamon brown with turquoise stains, a white context that stains vinaceous to fuscous or dark violet and white scabers becoming violet or dark brown. The whitish cream color and the tubular hyphae of the pileipellis places *L. violaceotinctum* in Section *Scabra* Smith, Thiers & Watling, similar to *Leccinum cyaneobasileucum* Lannoy & Estadès from France (Lannoy and Estades, 1995). *Leccinum cyaneobasileucum* has a pileus that can be completely white or greyish brown to light brown, its stipe scabers are white then grayish brown, it has larger spores (11-21 ×4-7 µm vs. 12-16 × 4-5.6 µm) and smaller hymenial cystidia (32-43.5 × 5.5-7.5 µm vs. 20-52 × 6.4 -10.2 µm).

Genus *Phylloporus* Quél.

36. ***Phylloporus boletinoides*** A.H. Sm. & Thiers, Contr. Monogr. N. Amer. *Suillus*, p. 105 (1964). (Figs 72, 79)

Pileus 40 mm diam., plano-convex, densely covered with erect fibrillose (pyramidal) squamules or subtomentose over margin, reddish brown (6E5-6) with grayish brown (6E4) hues; margin strongly inrolled. *Context* white, becoming very slowly faint bluish above lamellae; 10 mm thick at center. *Odor* faintly of cinnamon when cut. *Taste* not distinctive. *Lamellae* decurrent, 3 mm wide, close, deep grayish olivaceous (4D4), intervenose, forked both toward and away from margin, edge even, very finely fimbriate-bristling. *Stipe* 35 mm long, 7 mm wide, equal, with slightly bulbous base, dry, finely pruinose over upper 2/3, concolorous with pileus, turning rust brown (6E8) from handling. Context creamy buff (near 4A3). *Basal mycelium* pale buff. NH_4OH on pileus instantly violet purple then dark ochre orange in areas. *Spore print* not obtained.

Basidiospores 12-14.4 × 4.8-6.8 µm (n = 20; 12.82 ± 0.97 × 5.60 ± 0.48; Q_m = 2.37 ± 0.15), ellipsoid, orange brown or yellowish brown in KOH, dextrinoid in Melzer's. *Basidia* 36-46.4 × 8.8-9.6 µm, cylindric or cylindric-clavate, (2-) 4-sterigmate. *Basidioles* 30.4-42.4 × 8.8-9.6 µm, clavate. *Hymenial cystidia* 62.4-88 × 7.2-15.2 µm, cylindrical to fusoid. *Pileipellis* an entangled trichodermium of erect hyphae 4.8-14.4 µm diam., long-multiseptate; some moderately thick-walled; with grayish yellow or yellow contents in KOH, orange brown to dextrinoid in Melzer's; end cells 45.6-84 × 8-11.2 µm, cylindrical, some with subacute apex. *Stipitipellis* hyphae 4-16 µm diam., interwoven. *Caulocystidia* 23.2-101.6 × 6.4-12 µm, fusoid, broadly clavate, cylindric-ampullaceous; *dermatobasidia* present.

Habitat: Solitary on a dead tree.

Known distribution: Maine to Florida, west to Texas in North America; Belize in Central America (first report for Central America).

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Reserve, Douglas da Silva, Forestry Station, swamp near British Military area, 16°58'8.9"N, 88°59'38.4"W, 450 m asl, 6 October 2003, *TJB 9681,* BZ 3224 (CORT, CMFR).

Notes: *Phylloporus boletinoides* is distinguished by the brown color over the pileus and stipe surfaces, pale olivaceous to dark olive hymenophore and pallid basal mycelium. This collection differs from Singer *et al.* (1990b) in the NH_4OH reaction on the pileus surface, which is a deep violet purple instead of reddish purple, a dextrinoid reaction in Melzer's in the pileipellis hyphae and it has longer basidia (36-46.4 µm vs. 27-35 µm).

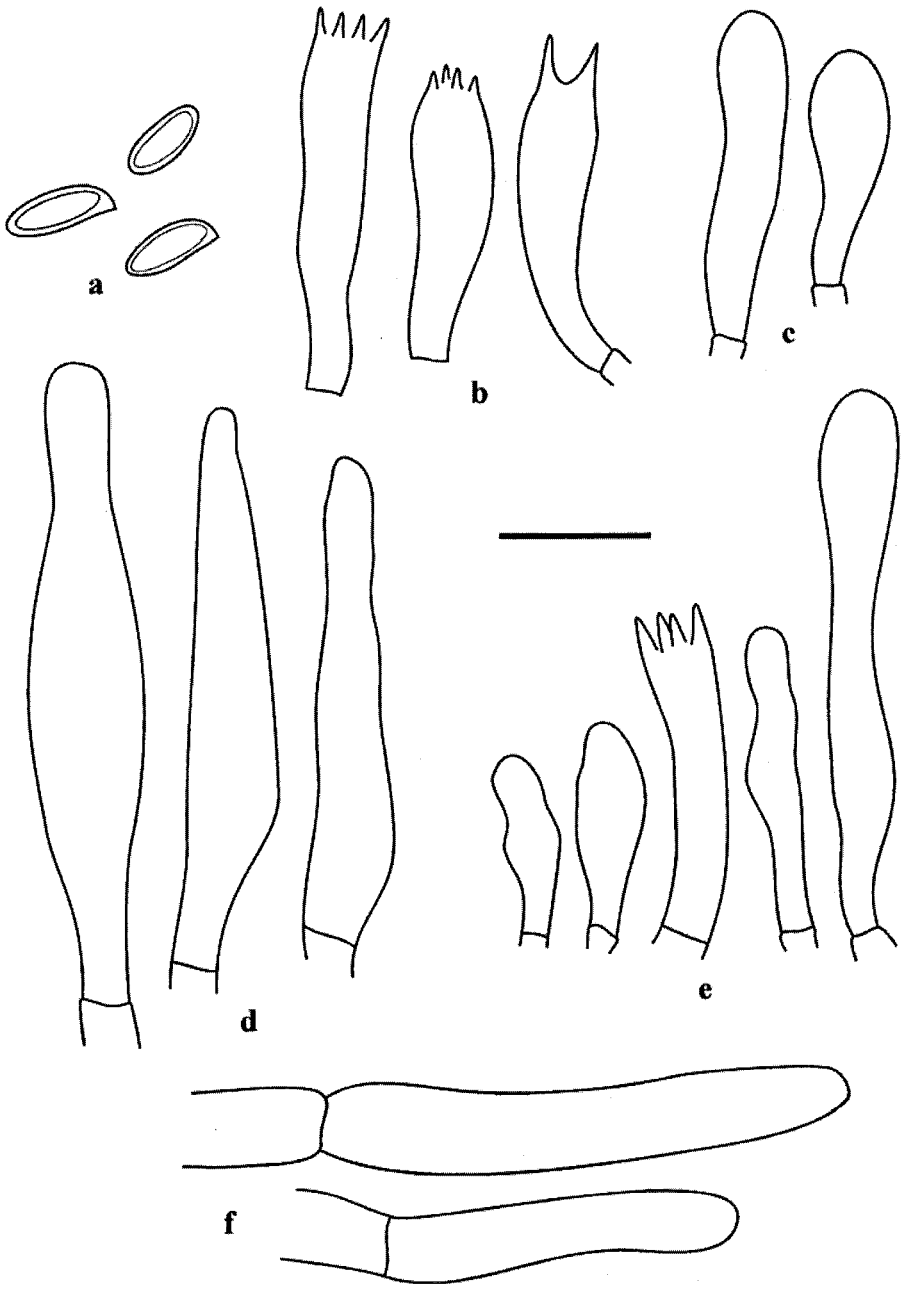


Fig. 72. *Phylloporus boletinoides*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** Caulocystidia and dermatobasidium; **f.** End-cells of pileipellis. *TJB 9681*. Scale bar = 20 μm.

37. ***Phylloporus rhodoxanthus*** (Schwein.:Fr.) Bres., Fung. Trident. 2(14): 95 (1900). (Fig. 73)

Synonyms:

Agaricus rhodoxanthus Schwein., Syn. Fung. Carol. Sup.: 83 (1822).

Xerocomus rhodoxanthus (Schwein.) Bresinsky & Manfr. Binder, in Bresinsky & Besl, Regensb. Mykol. Schr. 11: 233 (2003).

Pileus 15 mm diam., broadly convex to plane, finely matted tomentose, smooth, yellow brown (6E7 to 5D5). *Context* creamy yellow or buffy cream, solid, 15 mm thick. *Odor* none. *Taste* mild. *Lamellae* long decurrent, 9 mm wide, deep golden yellow (4B-C7), close, some forked, lamellulae irregular, 1-2 tiered. *Stipe* 30 mm long, 13 mm wide, tapered to base, with extended lamellulae or extended lines or striae at apex, fibrillose-pruinate overall, ground color creamy to yellow especially at base, with reddish brown pruina. *Basal mycelium* yellow. NH_4 on pileus surface produces a green flash. *Spore print* not obtained.

Basidiospores 11.2-16.8 × 4.8-6.4 µm (n = 20; 13.72 ± 1.61 × 5 ± 0.44; Q_m = 2.75 ± 0.34), ellipsoid, greenish yellow to pale yellowish brown in KOH, yellowish brown or dextrinoid in Melzer's. *Basidia* 40.8-46.4 × 7.2-8.8 µm, cylindric, 4-sterigmate. *Basidioles* 30.4-41.6 × 7.2-8 µm, clavate. *Pleurocystidia* 52.8-108.8 × 14.4-20.8 µm, cylindrical, tapered at base, hyaline in KOH. *Pileipellis* a tangled layer of repent or erect hyphae 5.6-17.6 µm diam., multi-septate, some moderately thick-walled, with pale grayish yellow or golden yellow contents in KOH, yellowish brown or dextrinoid in Melzer's; end cells cylindrical or clavate, short to elongated, some inflated. *Stipitipellis* hyphae 4-15.2 µm diam., interwoven, hyaline in KOH, giving rise to clusters of *caulocystidia*; these 16-40 × 9.6-17.6 µm, clavate, broadly clavate or cylindrical, mostly thick-walled.

Habitat: Solitary on soil under *Quercus oleoides*.

Known distribution: Eastern USA in North America; Belize in Central America (first report for Central America).

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, camp ground, 16°58'22.9"N, 88°59'44"W, 456 m asl, 9 January 2002, *TJB 9219*, BZ 769 (CORT, CFMR).

Notes: *Phylloporus rhodoxanthus* is distinguished by the tawny olivaceous with cinnamon hues pileus, a yellow hymenophore and a stipe surface that becomes brown. Our collection differs from those described by Singer and Gómez (1984) in having a yellow brown pileus, larger basidia (40.8-46.4 × 7.2-8.8 µm vs. 28-37 × 6-9 µm) and the hymenial cystidia are cylindrical rather than ventricose.

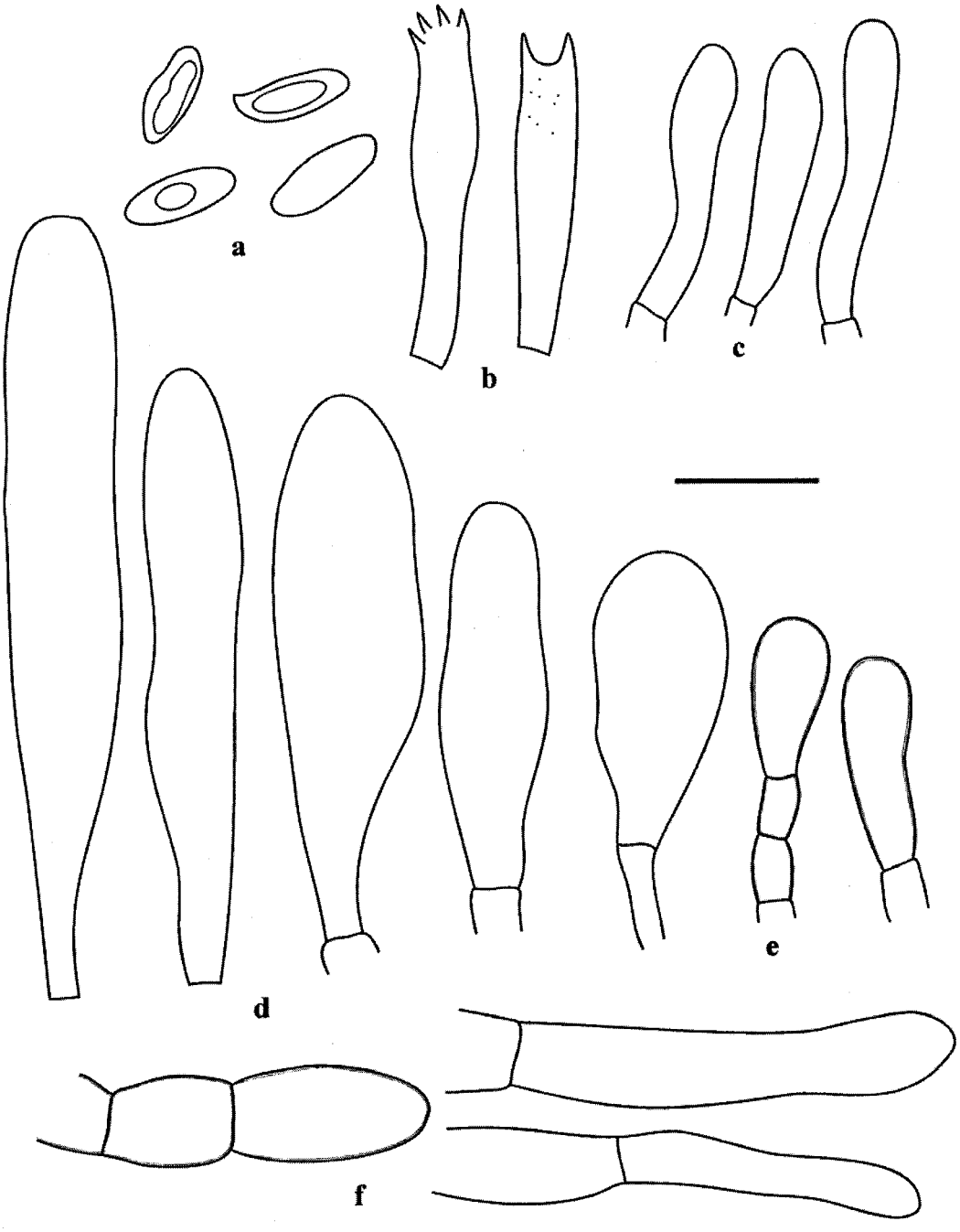


Fig. 73. *Phylloporus rhodoxanthus.* **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** Caulocystidia; **f.** End-cells of pileipellis. *TJB 9219.* Scale bar = 20 μm.

38. ***Phylloporus scabripes*** B. Ortiz & M.A. Neves, **sp. nov.** (Figs 74, 80-81)
MycoBank: 511057

Etymology: *scabri* - rough, *pes* - foot; for the scabrous stipe surface.

Pileus tomentosus, siccus, pallide rubro-brunneus, demum alutaceus, margo involutus. *Contextus* flavus, immutans. *Lamellae* decurrentes, approximatae, flavidae, ubi contusi vinaceo-brunneae. *Stipes* furfuraceus, cum squamulae erecta vel recurvata, aequalus, sursum rubrobrunneus, deorsum cremeus.

Pileus 28-65 (-75) mm diam., convex, broadly convex, tomentose, dry, pale reddish brown (6D4), paler with age to tan (near 5C4); margin strongly inrolled then incurved or remaining inrolled. *Context* yellow (2A3-4), not bruising, 10 mm thick at center. *Odor* not distinctive. *Taste* mild. *Lamellae* decurrent, 7 mm wide, close, Spectrum Yellow (3A8) to bright olivaceous green (3C7-8), edge even, concolorous, spotting vinaceous brown where damaged (not immediately). *Stipe* 30-50 (-60) mm long, 7-15 mm wide, equal, terete, furfuraceous, with erect or recurved squamules, some more or less columnar, dry; ground color red brown (6D5) above, yellow cream (3A2-3) over lower 1/2 or 1/3, some with buff tan (15B3) at middle, but quickly fading, with yellow to reddish brown scales. *Basal mycelium* bright yellow (3A3-2A3). NH_4OH (vapors) on pileipellis and stipitipellis instantly bright green, then slowly vinaceous lilac (purple); context under pileipellis slowly vinaceous purple just below the surface, the rest remaining yellow. *Spore print* not obtained.

Basidiospores 9.6-12.8 × 3.2-4.8 µm (n = 20; 11.08 ± 0.91 × 3.84 ± 0.56; Q_m = 2.93 ± 0.38), fusiform, smooth, pale greenish yellowish brown in KOH, orange to slightly dextrinoid in Melzer's solution. *Basidia* 33.6-38.4 × 9.6 µm, cylindric to cylindric-clavate, 4-sterigmate. *Basidioles* 25.6-39.2 × 7.2 µm, cylindric to cylindric-clavate. *Pleurocystidia* 43.2-80 × 13.6-15.2 µm, broadly cylindrical, broadly clavate, hyaline in KOH. *Pileipellis* a tangled layer of repent or erect hyphae 4-13.6 µm diam., thin to moderately thick-walled, end cells cylindrical, encrusting pigments yellowish brown in H_2O, dissolving very fast with the application of KOH, producing a yellowish brown color reaction; hyaline or with golden yellow, grayish yellow or grayish green contents in KOH. "Fleeting amyloid" positive reaction in the hymenophoral trama with Melzer's. *Stipitipellis* hyphae 4-21.6 µm diam., subparallel, hyaline in KOH, some with yellow contents, some thick-walled. *Caulocystidia* 16-82.4 × 7.2-19.2 µm, clavate, cylindric-clavate, fusoid, ventricose, moderately to thick-walled; *dermatobasidia* present.

Habitat: Scattered or subcaespitose on sandy soil under *Quercus* spp. and *Pinus caribaea*.

Known distribution: Belize.

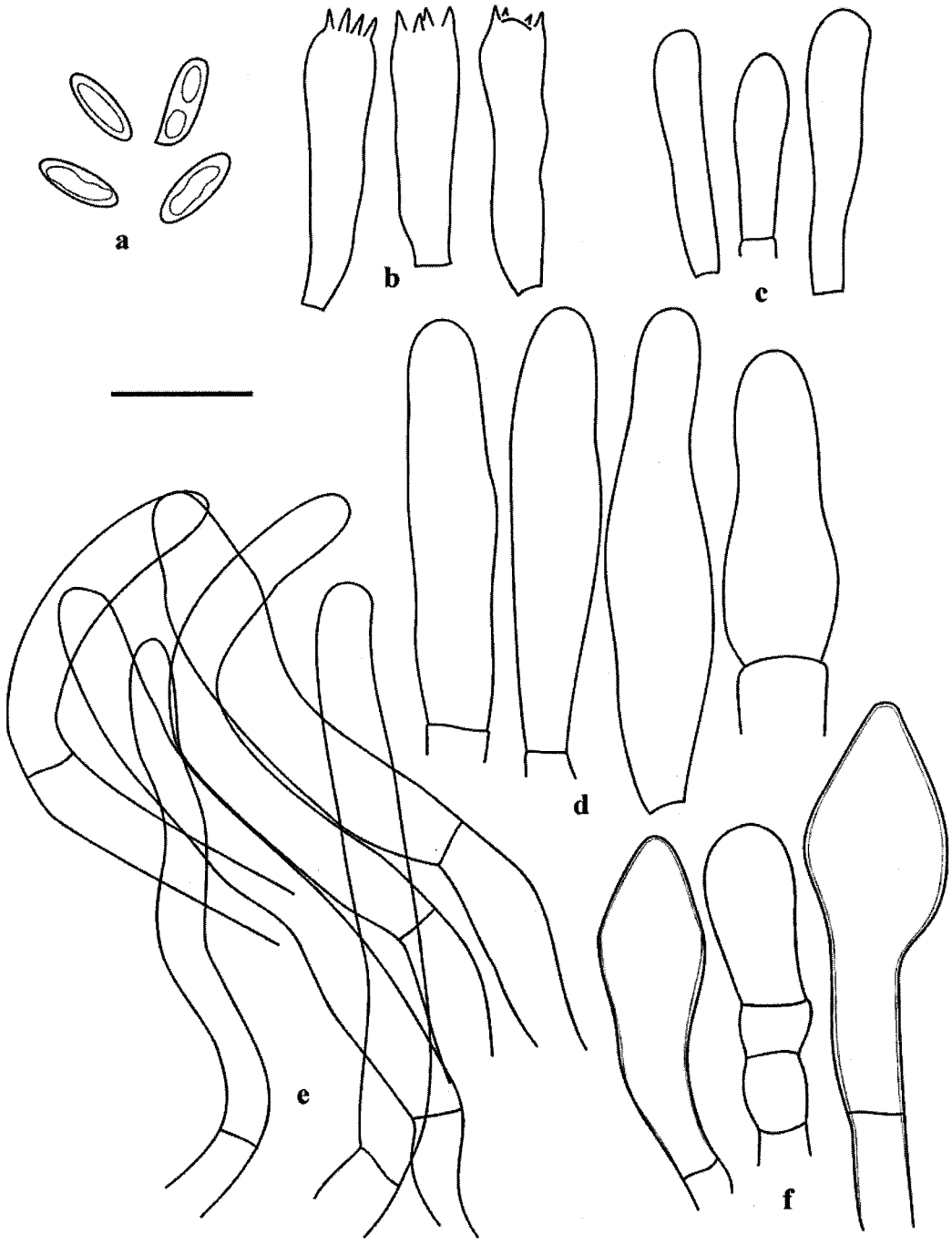


Fig. 74. *Phylloporus scabripes*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** Pileipellis; **f.** Caulocystidia. *TJB 9709.* Scale bar = 20 µm.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, Foster's property, 12 October 2003, *TJB 9709*, BZ 3252 (CORT, **holotype**; BRH, CFMR, **isotypes**); 13 October 2003, *BOS 613*, BZ 3166 (BRH, CFMR); 14 October 2003, *BOS 621*, BZ 3174 (BRH, CFMR); *TJB 9724*, BZ 3267 (BRH, CORT, CFMR); 15 October 2003, *REH 8558*, BZ 3339 (BRH, CFMR, NY); *TJB 9752*, BZ 4187 (BRH, CORT, CFMR); Tropical Education Center, 17°21'27"N, 88°32'30"W, 23 m asl, 16 August 2002, *BOS 278*, BZ 1623 (BRH, CFMR). Cayo District: Mountain Pine Ridge Reserve, Privassion Camp, Privassion Creek, 17°2'5.1"N, 88°56'53.3"W, 450 m asl, 7 October 2003, *REH 8531,* BZ 3312 (BRH, NY, CFMR).

Notes: *Phylloporus scabripes* is distinguished by the grayish orange to reddish brown pileus, the yellow to olivaceous hymenophore, a recurved-squamose stipe surface with yellow ground color and yellow to reddish brown scales, a pileus surface that becomes greenish blue to green with the application of NH_4OH and the absence of clamp connections in its hyphae. It belongs to Section *Phylloporus*, but none of the previously described species in this section has a recurved squamose stipe. Molecular sequences of the rDNA ITS and rDNA LSU genes confirmed this as a new species of *Phylloporus* (Neves, unpublished data).

Genus *Pulveroboletus* Murrill

39. ***Pulveroboletus auriflammeus*** (Berk. & M.A. Curtis) Singer, Amer. Midl. Nat. 37: 10 (1947). (Figs 75, 82)

Synonyms:

Boletus auriflammeus Berk. & M.A. Curtis, Grevillea 1: 36 (1872).

Ceriomyces auriflammeus (Berk. & M.A. Curtis) Murrill, Mycologia 1 (4): 147 (1909).

Boletus laeticolor Berk. & M.A. Curtis, in M.A. Curtis, Bot. N. Carol., p. 96 (1867) (*nom. nud.*).

Pileus 27 mm diam., convex to plane, floccose to felty, not viscid; ground color Orange Yellow (4A8) with Spectrum Yellow (3A8) to Tawny (6-7D7) fibrils, not bruising, orange brown in KOH, paler in NH_4OH; worm hole color Chamois (4A4); margin decurved. *Context* soft, white or pale yellow, not bruising or slightly yellowing, negative in KOH and NH_4OH; 5 mm thick at center, 2.5 mm at margin. *Odor* aromatic to spicy. *Taste* fungoid or slightly spicy. *Tubes* adnexed with decurrent tooth, depressed around stipe, 6 mm long, Sulfur Yellow (2A5), not bruising, negative in KOH; *pores* radially elongated, compound, 1-1.5 × 0.5-1 mm, Sulfur Yellow (2A5), some Orange Yellow (4A8), with some pores Crimson (10C8) at times, not bruising. *Stipe* 35 mm long, 6 mm wide at apex, 7 mm at middle, 9 mm at base, clavate with tapered base, reticulate upper half, pruinose overall; ground color Orange Yellow (4A8) with Spectrum Orange (6A8) ornaments; not bruising, negative in KOH and NH_4OH. *Context* soft, white or creamy, bruising pale yellow, negative in KOH and NH_4OH. *Basal mycelium* pale yellow. *Spore print* not obtained.

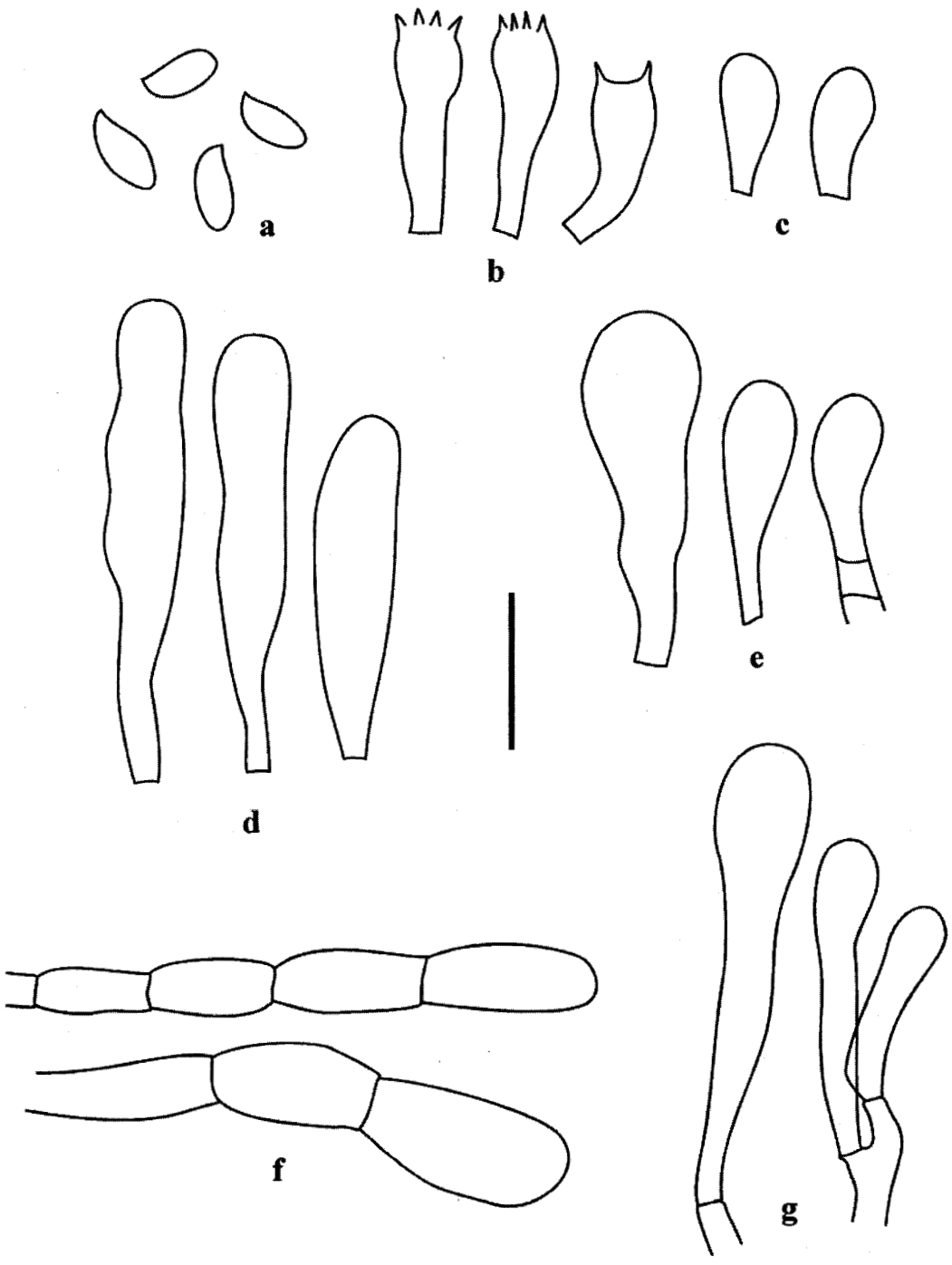


Fig. 75. *Pulveroboletus auriflammeus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 384.* Scale bar = 20 µm.

Basidiospores 8.8-10.4 × 4-4.8 µm (n = 20; 9.8 ± 0.63 × 4.36 ± 0.41; Q_m = 2.26 ± 0.21), ellipsoid; hyaline in KOH, dextrinoid in Melzer's. *Basidia* 19.2-25.6 × 7.2-10 µm, clavate or broadly clavate, (2-) 4-sterigmate. *Basidioles* 16-20.8 × 6.4-8 µm, clavate. *Pleurocystidia* 43.2-70 × 8-12 µm, clavate, broadly clavate, cylindric with tapered base. *Cheilocystidia* 20.8-43.2 × 8-14.4 µm, broadly clavate to sphaeropedunculate. *Pileipellis* an entangled trichodermium of erect hyphae 5.2-19.5 µm diam., multi-septate, hyaline or grayish yellow in KOH, some encrusted in bright yellow pigments, golden yellow in Melzer's; end cells mostly cylindrical, clavate, short to elongated. *Stipitipellis* hyphae 2.4-10.4 µm diam., interwoven, grayish yellow in KOH. *Caulocystidia* of 24-57.6 × 5.6-12 µm, numerous, cylindric-clavate or broadly clavate, grayish yellow in KOH.

Habitat: Solitary under *Quercus peduncularis* or *Quercus* spp.

Known distribution: New York to Florida, west to Ohio and Tennessee in North America; Belize in Central America (first report for Central America).

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Macal River, Guacamayo Bridge at the oak stand above river, 16°53'16.2"N, 89°2'22.2"W, 594 m asl, 20 October 2002, *BOS 384,* BZ 1733 (CFMR); Five Sisters Lodge, near fork in entrance road to Lodge, 17°2'20.2"N, 88°58'16.2"W, 432 m asl, 29 November 2002, *BOS 477*, BZ 2405 (CFMR).

Notes: *Pulveroboletus auriflammeus* can be distinguished by the bright orange yellow color of the basidiocarp, with white or pale yellow unchanging context, a reticulate stipe and the sphaeropedunculate or broadly clavate cheilocystidia. Our collections agree with those described by Coker and Beers (1943) and Baroni (1998) in their macromorphology; however it differs slightly in the microcharacters since it shows clavate or cylindric pleurocystidia with tapered bases rather than the broadly ventricose or fusoid ampullaceous shapes described by Baroni (1998).

40. ***Pulveroboletus ravenelii*** (Berk. & M.A. Curtis) Murrill, Mycologia 1 (1): 9 (1909). (Figs 76, 83)

Synonyms:

Boletus ravenelii Berk. & M.A. Curtis, Ann. Mag. Nat. Hist. II, 12: 429 (1853).

Suillus ravenelii (Berk. & M.A. Curtis) Kuntze, Rev. Gen. Pl. 3: 536. (1898).

Pileus 22-40 (-65) mm diam., hemispherical to broadly convex, felty, appressed squamulose becoming rimose at center, slightly viscid when wet; Sulfur Yellow (2A5) at margin, Trogon Yellow (4A5) at center, with Cinnamon (5C4) or reddish brown areas, bruising greenish blue then Parrot Green (28D-E7), reddish brown in KOH, negative in NH_4OH; margin appendiculate. *Context* watery, soft, pale yellow, bruising blue; 7-11 mm thick at center, 3-6

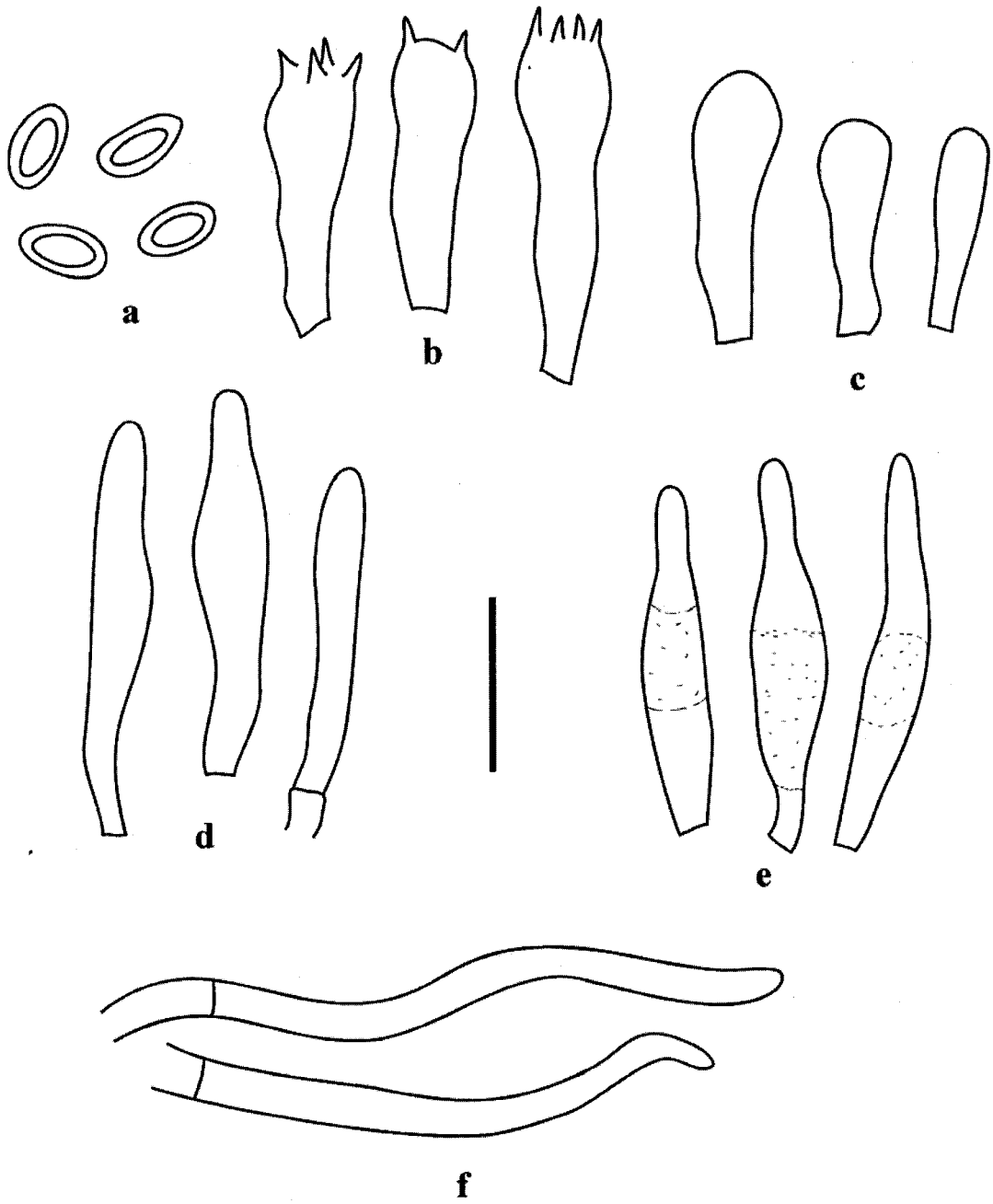


Fig. 76. *Pulveroboletus ravenelii.* **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis. *BOS 483.* Scale bar = 20 µm.

mm at margin. *Odor* not distinctive. *Taste* slightly sour. *Tubes* adnexed, 2.5-5 mm long, pale yellow, bruising blue, negative to grayish vinaceous in KOH and

NH_4OH; *pores* nearly circular, compound, 1-2/mm, pale yellow, bruising blue. *Stipe* 38-56 mm long, 8-12 mm wide at apex, 9-14 mm at middle, 8-10 mm at base, subequal, scurfy; Sulfur Yellow (2A5) to Spectrum Yellow (3A8), bruising blue, becoming reddish brown; worm hole color Brick Red (8-9E8), reddish brown in KOH, negative in NH_4OH. *Context* fibrous, pale yellow, bruising blue, grayish vinaceous in KOH, negative in NH_4OH. *Basal mycelium* white. *Partial veil* membranous, fragile, thin, Sulfur Yellow (2A5), staining blue after bruising. *Spore print* not obtained.

Basidiospores 8.8-9.6 × 4.8-5.6 µm (n = 20; 9.28 ± 0.4× 5.08 ± 0.39; Q_m = 1.83 ± 0.13), subglobose, pale yellow or orange brown in KOH, pale yellow or reddish brown in Melzer's. *Basidia* 28-36 × 9.6 µm, clavate, (2-) 4-sterigmate. *Basidioles* 22-29.6 × 4.8-8.8 µm, clavate. *Pleurocystidia* 36-45.6 × 4.8-6.4 µm, fusoid, fusoid-ventricose or cylindrical. *Cheilocystidia* 38.4-44 × 6.4-8 µm, fusoid-ampullaceous, fusoid-ventricose, melleous. *Pileipellis* a tangled layer of repent hyphae 2.4-9.6 µm diam., long branched hyphae, in some areas embedded in a gelatinous layer, with pale yellow, dull golden yellow or pale grayish yellow contents in KOH and with greenish yellow granules. *Stipitipellis* hyphae 5.6-13.6 µm diam., multi-septate, contents grayish yellow or yellow in KOH. *Veil hyphae* 2.4-4.8 µm diam., interwoven, hyaline or very pale yellowish gray in KOH.

Habitat: Gregarious under *Pinus caribaea* and *Quercus* spp.

Known distribution: Eastern Canada to the Gulf of Mexico, west to Michigan, Texas and California and south to Mexico in North America; Belize, Nicaragua and Costa Rica in Central America; Colombia in South America.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, 1000 Foot Falls, Park grounds near falls overlook, 17°3'35.4"N, 88°50'52.8"W, 644 m asl, 30 November 2002, *BOS 483,* BZ 2411 (BRH); 18 November 2004, *OKM 28720* BZ 4034 (CFMR, VPI); Douglas da Silva, Forestry Station camp ground, 16°58'22.9"N, 89°59'44"W, 456 m asl, 9 January 2002, *LL 15*, BZ 812 (BRH, CORT, CFMR); 13 October 2002, *BOS 355,* BZ 1704 (BRH, CFMR); near Forestry Station, 13 October 2002, *TJB 9387*, BZ 2107 (BRH, CORT); 1 December 2002, *CLO 4304*, BZ 2451 (BRH, CFMR).

Notes: *Pulveroboletus ravenelii* is characterized by the pulverulent thin membranous veil of yellow color, the reddish brown colors over pileus and stipe and the quick change to blue or greenish blue after bruising in most parts of the fruiting body. Our collections agree with those described by Singer (1947).

Genus *Retiboletus* Manfr. Binder & Bresinsky

41. ***Retiboletus griseus*** (Frost in Peck) Manfr. Binder & Bresinsky, Feddes Repert., 113 (1-2): 37 (2002). (Figs 84, 90)

Synonyms:
Boletus griseus Frost, Ann. Rept. N. Y. State Museum 29: 45 (1878).
Ceriomyces griseus (Frost) Murrill, Mycologia 1: 145 (1909).
Xerocomus griseus (Frost) Singer, Ann. Mycol. 40: 44 (1942).
Tubiporus griseus (Frost) Imai{?} 1968.

Pileus 46-92 mm diam., broadly convex to convex, felty, not or slightly viscid when wet; ground color Sayal Brown (6D5) to Tawny Olive (5C4) with Raw Umber (5E5-6) fibrils, reddish brown in KOH and NH_4OH; worm hole color Tawny (6-7D7); margin decurved to plane. *Context* soft, cream bruising pale grayish vinaceous, becoming yellow in some areas; 9-18 mm thick at center, 3-6 mm at margin. *Odor* bread-like. *Taste* sweet. *Tubes* adnexed, 5-8 mm long, cream, bruising Fawn Color (6D3); *pores* irregular, cream, bruising Ground Cinnamon (6E4), becoming in some areas bright orange yellow. *Stipe* 44-57 mm long, 11-20 mm wide at apex, 12-19 mm at middle, 11-13 mm at base, solid or stuffed, equal or tapering downward, moderately reticulate over the upper 2/3; ground color cream or grayish brown with orange yellow stains; reticulum Verona Brown (6E7). *Context* soft to fibrous, cream, bruising pale grayish vinaceous, with yellow or orange yellow stains at edges and base. *Spore print* Hair Brown (5F5).

Basidiospores 10.4-12 (-14.4) × 3.2-4 (-4.8) µm (n = 20; 12.28 ± 1.36 × 3.88 ± 0.48; Q_m = 3.20 ± 0.25), fusiform, pale grayish greenish yellow in KOH, dextrinoid in Melzer's. *Basidia* 23.2-28.8 × 8.8-9.6 µm, clavate, 4-sterigmate. *Basidioles* 13.6-28.8 × 8.8-9.6 µm, clavate. *Pleurocystidia* 36-48.8 × 8-10 µm, fusoid-ventricose, clavate or ventricose rostrate, some with melleous contents. *Cheilocystidia* 20-32.8 × 6.4-8.0 µm, fusoid-ventricose, ventricose rostrate, melleous. *Pileipellis* a tangled layer of repent hyphae 3.2-16.8 µm diam., subgelatinous in some areas, hyaline or with pale brown or yellowish brown contents in KOH, golden yellow or reddish brown in Melzer's; end cells cylindrical. *Stipitipellis* hyphae 3.2-10.4 µm diam., interwoven, subgelatinous, hyaline in KOH. *Caulocystidia* 16-35.2 × 5.6-10.4 µm, cylindric, fusoid ventricose, resembling chrysocystidia, with golden yellow to yellowish brown contents in KOH.

Habitat: Solitary to gregarious under *Pinus occidentalis* and *Quercus* spp.

Known distribution: Eastern North America, west to Minnesota, Arizona and south to Mexico; Belize and Guatemala in Central America; Dominican Republic in the Caribbean.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 12 October 2002, *BOS 351,* BZ 1700

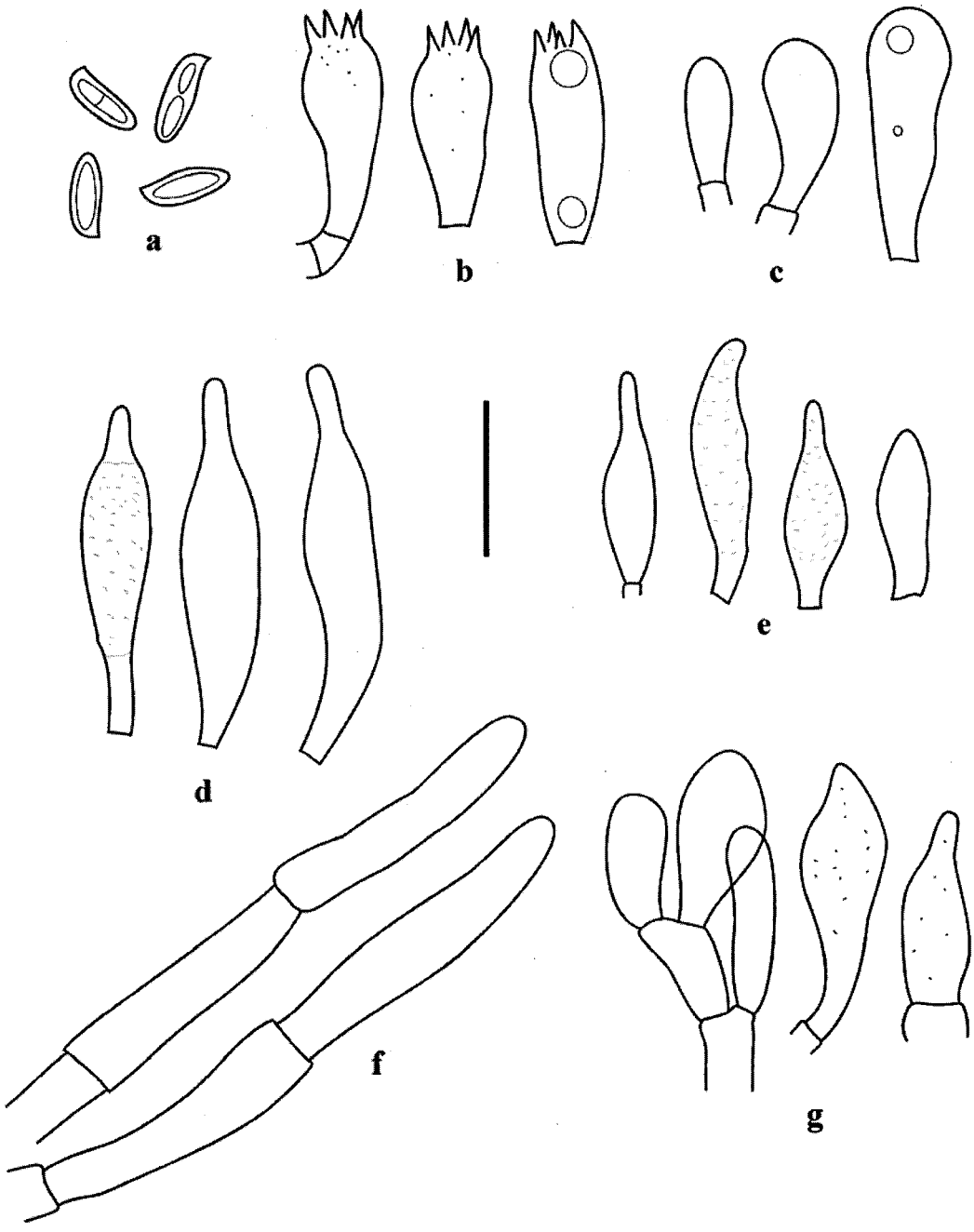


Fig. 84. *Retiboletus griseus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 351*. Scale bar = 20 μm.

(BRH, CFMR). DOMINICAN REPUBLIC. La Vega Province: Jarabacoa area, before golf course and Forestry School, on small side road to the north with brick arches, 19°4'N, 70°52'W, 550 m asl, 10 November 2003, *TJB 9768*, DR 2840 (JBSD, CORT, CFMR); 13 November 2003, *TJB 9790*, DR 2862 (JBSD, CORT, CFMR).

Notes: *Retiboletus griseus* is distinguished by the grayish brown colors mainly over pileus and stipe surfaces, a pallid hymenophore and a reticulate stipe, with the reticulum becoming brown or black in some areas with age. Our collections agree with those described by Singer (1947) and Smith and Thiers (1971), although they have orange yellow stains on the hymenophore and stipe surfaces, a character not mentioned in previous descriptions.

42. *Retiboletus ornatipes* (Peck) Manfr. Binder & Bresinsky, Feddes Repert., 113 (1-2): 37 (2002). (Figs 85, 91)

Synonyms:

Boletus ornatipes Peck, Ann. Rept. N. Y. State Museum 29: 67 (1878).

Suillus ornatipes (Peck) Kuntze, Rev. Gen. Pl. 3: 536 (1898).

Pileus 23-42 mm diam., convex, velvety to felty, not viscid, grayish olive (3D-5D), not bruising, brown in KOH, negative in NH_4OH; worm hole color Light Drab (5D3) or yellow; margin decurved, forming a band. *Context* Sulfur Yellow (2A5) bruising Spectrum Yellow (3A8) or pale orange yellow, negative in KOH and NH_4OH; 8-10 mm thick at center, 2-3 mm at margin. *Odor* not distinctive. *Taste* slightly to strongly bitter. *Tubes* adnate with a tooth, 3-6 mm long, Sulfur Yellow (2A5), bruising yellow ochre or orange brown, brown in KOH, negative in NH_4OH; *pores* nearly circular to radially elongated, 2-3/mm, pale yellow or Straw Yellow (3B4) becoming Robin Rufous (7E8) with age, darkening when bruised. *Stipe* 41-77 mm long, 7-11 mm wide at apex, 8-12 mm at middle, 7-9 mm at base, subequal or slightly tapered at base, with a well developed reticulum over upper 2/3 or overall, surface and reticulum Sulfur Yellow (2A5), bruising or becoming Verona Brown (6E7), reddish brown in KOH, bright yellow in NH_4OH. *Context* fibrous, Sulfur Yellow (2A5) bruising Spectrum Yellow (3A8) becoming orange yellow or yellowish brown with time. *Basal mycelium* Spectrum Yellow. *Spore print* Sayal Brown (6D5).

Basidiospores 9.6-12 (-13.6) × 3.2-4 µm (n = 20; 11.48 ± 1.22 × 3.86 ± 0.31; Q_m = 3.00 ± 0.48,), fusiform, cylindrical, pale grayish greenish yellow in KOH, some dextrinoid in Melzer's. *Basidia* 29.6-44 × 8 µm, clavate, cilindric-clavate, 4-sterigmate. *Basidioles* 25.6-47.2 × 8-8.8 µm, clavate, cilindric-clavate. *Pleurocystidia* 38.4-56 × 5.6-8 µm, fusoid-ventricose, cylindric-fusiform, some encrusted and dextrinoid in Melzer's. *Cheilocystidia* 32-51.2 × 4.8-6.4 µm, cylindrical, sublanceolate. *Pileipellis* a tangled layer of repent hyphae 4-11.2 µm diam., hyaline or with grayish brown or orange brown contents in KOH, yellow or yellowish brown to brown in Melzer's, end cells

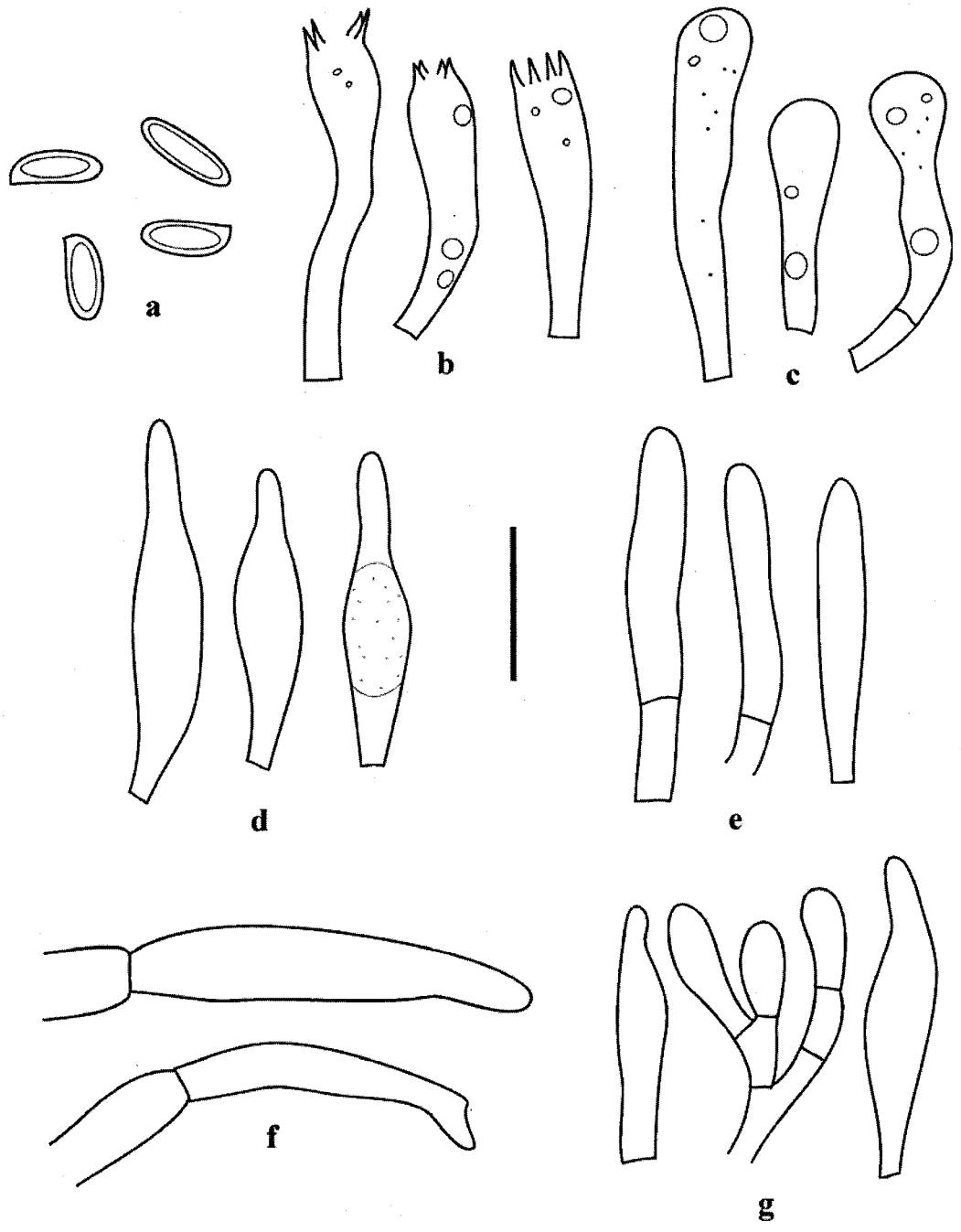


Fig. 85. *Retiboletus ornatipes.* **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 466.* Scale bar = 20 µm.

mostly cylindrical, some with a subacute apex. *Stipitipellis* hyphae 3.2-10.4 µm, parallel, interwoven and subgelatinous in some areas, hyaline in KOH. *Caulocystidia* 12-59.2 × 5.6-10.4 µm, some in clusters, clavate, fusoid to fusoid ampullaceous, hyaline or with grayish yellow contents in KOH.

Habitat: Gregarious under *Quercus* spp.

Known distribution: Eastern North America, west to Minnesota; Belize and Costa Rica in Central America.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Five Sister Lodge, lower Nature Trail, 17°2'16"N, 88°59'8"W, 308 m asl, 9 August 2001, *JCB 2001-237,* BZ 428 (BRH, CFMR); Macal River, Guacamayo Bridge at the oak stand above river, 16°53'16.2"N, 89°2'22.2"W, 594 m asl, 14 October 2002, *BOS 358*, BZ 1707 (BRH, CFMR); 26 November 2002, *BOS 466,* BZ 2393 (BRH, CFMR).

Notes: *Retiboletus ornatipes* is characterized by the yellow colors over the basidiocarp, a pileus with olive or brown color, a well-developed reticulum on stipe and a bitter taste. Our collections agree in general with those described by Singer (1947) and Smith and Thiers (1971).

43. ***Retiboletus vinaceipes*** B. Ortiz, Lodge & T.J. Baroni, **sp. nov.**

(Figs 86, 92-93)

MycoBank: 511058

Etymology: *vinacei* - wine; *pes* - foot; for the wine red stains on the stipe base.

Pileus coactus vel adpresse tomentosus, brunneus vel atrocinereo-brunneus. *Contextus* albidus, immutans. *Tubi* albidi, adnati, pori cinereo-albidi vel sordide luteoli. *Stipes* aequus, ad basim accuminatus, albidus, vinaceus ad basim, reticulatus, reticulum griseus, intus flavus, immutans.

Pileus 32-54 mm diam., broadly convex, convex/hemispheric, minutely pubescent, felty, or appressed tomentose, dull, Army Brown, Dark Drab (5E4), Hair Brown (5F5) to dark grayish brown (6-7E3) becoming paler to pale tan, red in NH_4OH. *Context* off-white, not bruising, pale Cinnamon Drab (7D4) in KOH, negative or pale brownish pink in NH_4OH; 8-13 mm thick at center. *Odor* none or astringent. *Taste* sweet, acidic or slightly bitter. *Tubes* adnate, 3.5-7 mm long, white, buff, or grayish tan (5B2) staining brown when cut; strawberry red in NH_4OH; *pores* circular to angular, 2-3/mm, grayish white or sordid yellow (3A2), with Tawny Olive (5C4) areas becoming Cinnamon Drab (7D4). *Stipe* 30-95 mm long, 7-18 mm wide, tapered at base, with a moderately developed reticulum on upper 2/3; ground color off white, pale gray to buff with the reticulum Drab Gray, Light Drab (5D3) to Dark Drab (5E4) and with a dark rhubarb red or vinaceous red discoloration at the base, red in NH_4OH near base. *Context* white, whitish cream to Buff (4B4), some chrome yellow at base, staining pale blue in some areas, pale yellow brown then blue grey in NH_4OH. *Basal mycelium* white.

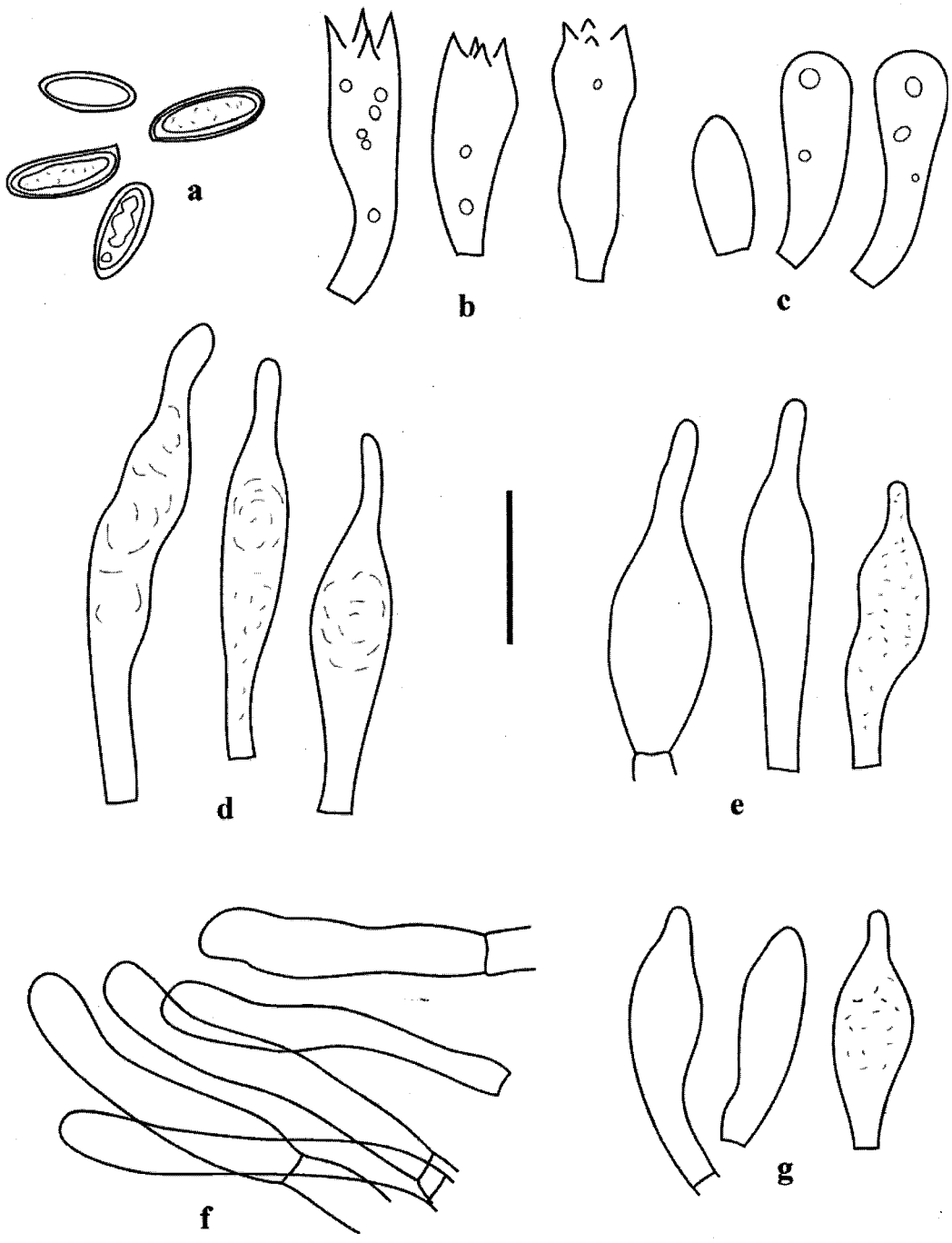


Fig. 86. *Retiboletus vinaceipes*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *DJL-DR-42*. Scale bar = 20 μm.

Basidiospores 9.6-16 × 4-4.8 µm (n = 20; 12.95 ± 1.65 × 4.34 ± 0.40; Q_m = 3.09 ± 0.35), fusiform, smooth, greenish yellow to yellow in KOH, orange brown in Melzer's. *Basidia* 24-37.6 × 8-11.2 µm, clavate, 4-sterigmate. *Basidioles* 16-32.8 × 5.6-10.4 µm, clavate. *Pleurocystidia* 48-64 × 7.2-10.4 µm, fusoid-ventricose, fusoid-ampullaceous, contents yellow to yellowish brown in KOH and bright orange brown in Melzer's. *Cheilocystidia* 32-49.6 × 8-13.6 µm, fusoid-ventricose, ventricose-rostrate, numerous, melleous, some with yellow to yellowish brown contents in KOH, contents bright orange brown in Melzer's. *Pileipellis* a tangled layer of repent hyphae 2.4-9.6 µm diam., encrusted pigments reddish brown in H_20, diffusing orange brown with the application of KOH, hyaline or with grayish yellow contents in KOH; end cells 32-76 × 4.8-9.6 µm, cylindrical or subclavate, with grayish yellow or yellowish brown contents in KOH. *Stipitipellis* hyphae 2.4-10 µm diam., interwoven, subgelatinous, with grayish yellow to orange yellow contents in KOH. *Caulocystidia* 14.4-48.8 × 4.8-12 µm, fusoid ventricose, ventricose rostrate, some as chrysocystidia with golden yellow to orange yellow contents in KOH.

Habitat: Caespitose or gregarious under *Pinus caribaea*, *P. occidentalis* and *Quercus* spp.

Known distribution: Belize in Central America; the Dominican Republic in the Caribbean.

Material examined: DOMINICAN REPUBLIC. Santiago Province: La Celestina, 19°23'17"N, 71°1'57"W, 550 m asl, 25 November 1999, *DJL-DR-42,* DR 1035 (CFMR, **holotype**; JBSD, **isotype**); *DJL-DR-42.1,* DR 1051 (JBSD, CFMR). BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, Forestry Station, 16°58'23"N, 88°59'37"W, 450 m asl, 10 August 2001, *TJB 9148*, BZ 336 (BRH, CORT, CFMR); first bridge on the way from Five Sisters Lodge to Douglas da Silva, near Privassion Camp, 16°N, 88°"W, 450 m asl, 24 November 2002, *BOS 459*, BZ 2386 (BRH, CFMR).

Notes: *Retiboletus vinaceipes* is distinguished by the grayish brown pileus, the white to grayish tan hymenophore that becomes brown with time, stipe ground gray to buff with a drab colored reticulum and the presence of a dark rhubarb or wine red stains over the stipe base; the context is also unusual since it is a whitish cream color that remains unchanged in the pileus context but stains blue in some parts of the stipe. In terms of the pileus and stipe colors and the presence of a reticulum, these collections resemble *R. griseus*, but *R. vinaceipes* differs from *R. griseus* because of the blue staining reaction in the stipe context, the presence of the red pigments over the stipe base and somewhat longer basidiospores (9.6-16 vs. 9-13 µm). Molecular sequences of the rDNA ITS and rDNA LSU genes confirmed this as a new species of *Retiboletus* (Ortiz-Santana, 2006). *Retiboletus vinaceipes* differs from *R. ornatipes* in having a grayish brown rather than yellow to olive yellow basidiomes. *Retiboletus retipes*, *R. ornatipes* and *R. flavoniger* (Halling) Manfr.

Binder & Bresinsky produce retipolide pigments, but *R. griseus* and *Tylopilus nigerrimus* (Heim) Hongo & Endo do not (Binder & Bresinsky, 2002b). Further studies are needed to determine if this new taxon produces retipolide pigments.

Genus *Tylopilus* P. Karst.

44. ***Tylopilus ballouii*** (Peck) Singer, Amer. Midl. Nat. 37: 104 (1947). (Figs 87, 94)

Synonyms:
Boletus ballouii Peck, Bull. N. Y. State Museum 157: 22. Pl. VIII (1912).
Gyrodon ballouii (Peck) Snell, Mycologia 33: 422 (1941).
Rubinoboletus ballouii (Peck) Heinem. & Rammeloo, Bull. Jard. Bot. Nat. Belg. 53: 295 (1983).

Pileus 18-86 mm diam., convex or broadly convex, subvelutinous or felty, becoming rimose at center, Cinnabar, Ferrugineous (8C-D6-7), Cinnamon (5C4) at center, Cinnamon Rufous (7C-D7), Mahogany Red (8D6), Brick Red (8-9E8), Mikado Brown (6D4-5) or Mars Brown (7F8) near margin, bright orange brown in KOH and NH_4OH; margin incurved, slightly projecting. *Context* solid, soft, white, bruising pale Tawny Olive (5C4) becoming Army Brown, negative in KOH and NH_4OH; 16 mm thick at center, 4 mm at margin. *Odor* bread-like. *Taste* slightly bitter or sour. *Tubes* adnexed or adnate with decurrent tooth, 3-6 mm long, pale cream, bruising Cinnamon (5C4); *pores* nearly circular or sublabyrinthine, compound, 1-2/mm, pure white then whitish cream, bruising Cinnamon (5C4). *Stipe* 10-50 mm long, 18-25 mm wide at apex, 18-20 mm at middle, 5-10 mm at base, equal or tapered or expanded at base, velutinous overall or finely pruinose upper half, finely felty lower half; ground color white at apex, pale Trogon Yellow (4A5) below, some Spectrum Yellow (3A8), Orange Yellow (4A8) or Spectrum Orange (6A8) at base, bruising brown at apex; negative in KOH and NH_4OH. *Context* soft, solid, white, bruising Cinnamon Drab (7D4) to Brussels Brown, negative in KOH and NH_4OH. *Basal mycelium* white. *Spore print* Tawny Olive (5C4).

Basidiospores 5.6-7.2 × 4-5.6 µm (n = 20; 6.36 ± 0.41 × 4.2 ± 0.51; Q_m = 1.53 ± 0.18), ovoid to ellipsoid, greenish gray in KOH, with brown wall in Melzer's. *Basidia* 28-32 × 7.2-8 µm, clavate, 4-sterigmate. *Basidioles* 14.4-25.6 × 4.8-7.2 µm, clavate. *Pleurocystidia* 24-38.4 × 6.4-8.0 µm, sublanceolate, fusoid. *Cheilocystidia* 28-47.2 × 10-11.2 µm, sublanceolate or fusoid, some encrusted, melleous, dextrinoid in Melzer's. *Pileipellis* a tangled layer of repent hyphae 3.2-7.2 µm diam., subgelatinous in some areas, with golden yellow or bright orange yellow-brown contents in KOH, orange yellow to bright orange in Melzer's; end cells cylindrical, elongated. *Stipitipellis* hyphae 2.4-17.6 µm diam., long, interwoven, hyaline or with grayish yellow or yellow contents in KOH. *Caulocystidia* 24-60 × 4-9.6 µm, versiform, clavate, fusoid, fusoid

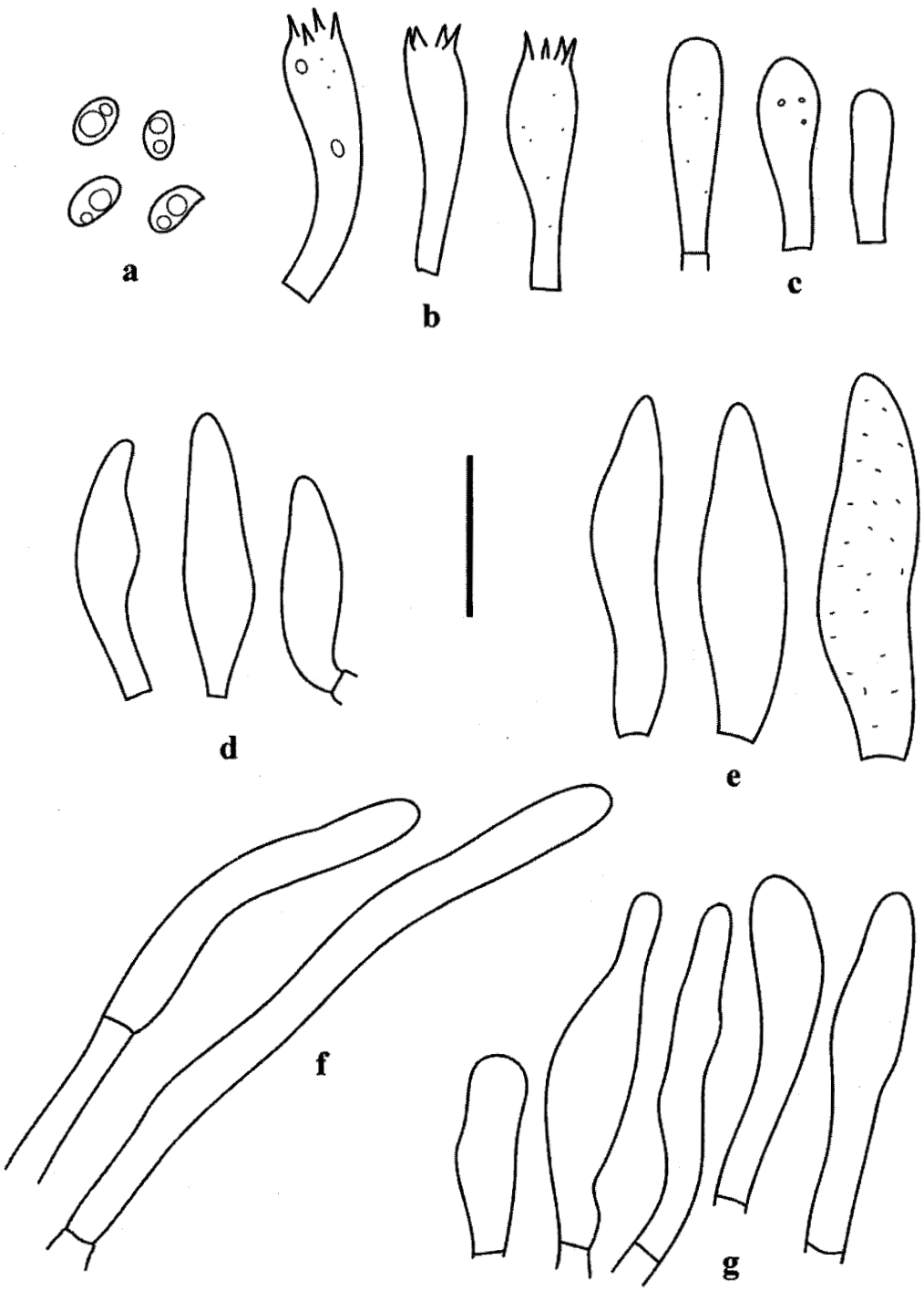


Fig. 87. *Tylopilus ballouii*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 481*. Scale bar = 20 µm.

ventricose or hyphoid, hyaline or grayish yellow in KOH, few with bright grayish yellow or yellow contents.

Habitat: Solitary or gregarious under *Pinus caribaea*, *P. occidentalis* and *Quercus* spp.

Known distribution: Massachusetts to North Carolina, west to Ohio and Texas and south to Mexico in North America; Belize and Costa Rica in Central America; the Dominican Republic in the Caribbean.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Five Sisters Lodge, near Lodge, 17°2'16"N, 88°59'7.8"W, 387 m asl, 30 November 2002, *BOS 481*, BZ 2409 (BRH, CFMR). DOMINICAN REPUBLIC. Santiago Province: Las Placetas, 19°14'26"N, 70°53'53"W, 660 m asl, 28 January 1998, *DJL-DR-30*, DR 574 (JBSD, CFMR).

Notes: *Tylopilus ballouii* is distinguished by the bright orange or orange brown colors of the pileus, a white or yellow stipe that lacks a reticulum, and a white hymenophore that becomes cinnamon when bruised. Our collections differ from Singer *et al.* (1991) in having shorter basidiospores (5.6-7.2 µm vs. 6.5-11 µm).

45. ***Tylopilus chromapes*** (Frost) A.H. Sm. & Thiers, Mycologia 60: 949 (1968). (Figs 88)

Synonyms:

Boletus chromapes Frost, Bull. Buffalo Soc. Nat. Sci. 2: 105 (1874).

Ceriomyces chromapes (Frost) Murrill, Mycologia 1(4): 145 (1909).

Leccinum chromapes (Frost) Singer, Amer. Midl. Nat. 37: 124 (1947).

Pileus 90 mm diam., hemispheric, smooth, dull, moist, sticky, pale Flesh Ocher (7C5) to Salmon Color (6B4) with Flesh Color (7B3) areas. *Context* white, unchanging, 12 mm thick at center. *Odor* none. *Taste* sour. *Tubes* deeply depressed, 10-20 mm long, Buff (4B4); *pores* 1-2/mm, warm brown. *Stipe* 115 mm long, 20-25 mm wide, dry, dull, scabrous; ground color white above, Cream Color (4A3) at middle, Spectrum Yellow (3A8) to Orange Yellow (4A8) at base with pink to red scabers. *Context* white, deep yellow to orange yellow at base. *Spore print* not obtained. *Macro-chemical reactions* not obtained.

Basidiospores 13.6-17.8 × 4.8-5.6 µm (n = 20; 15.71 ± 1.56 × 5.2 ± 0.41; Q_m = 3.03 ± 0.29), ellipsoid-fusiform, thick-walled, grayish greenish yellow in KOH, dextrinoid with dark brown wall in Melzer's solution. *Basidia* 25.6-36.8 × 12.8-16.8 µm, clavate, subpyriform, 4-sterigmate. *Basidioles* 24-25.6 × 9.6-10.4 µm, clavate to subpyriform. *Pleurocystidia* 40.8-51.2 × 4.8-6.4 µm, hyphoid or cylindric-fusoid. *Cheilocystidia* 28-36 × 5.6-8 µm, fusoid-ventricose, fusoid. *Pileipellis* a tangled layer of elongated repent hyphae 3.2-12 µm diam., subgelatinous in some areas, grayish yellow in KOH, yellow in Melzer's; end cells cylindrical. *Stipitipellis* hyphae 4-13.6 µm diam., interwoven, hyaline in KOH, yellow to yellowish orange to dextrinoid in

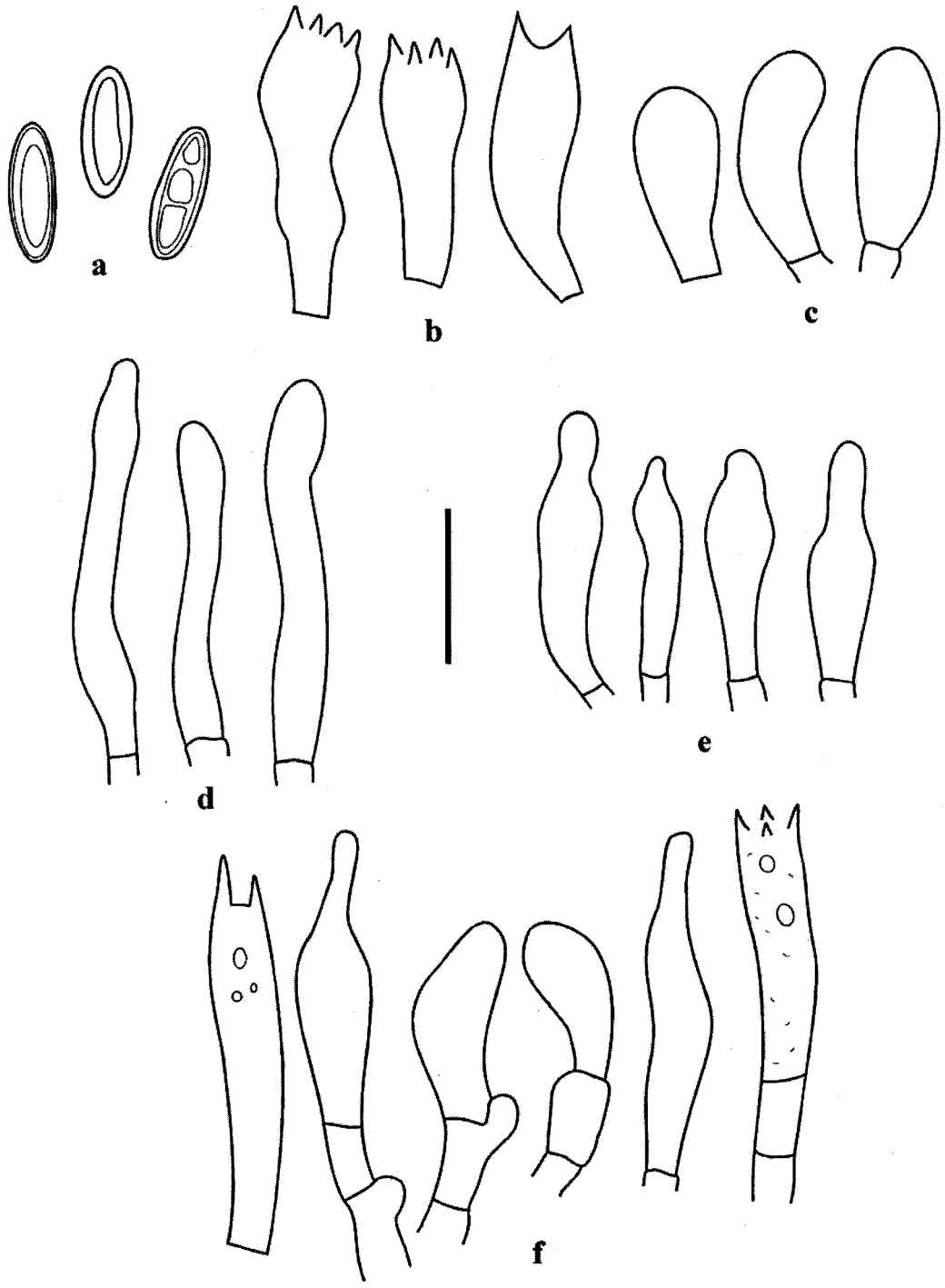


Fig. 88. *Tylopilus chromapes*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Caulocystidia and dermatobasidia. *DJL-DR-1.* Scale bar = 20 µm.

Melzer's. *Caulocystidia* 19.2-48 × 8-9.6 µm, clavate or fusoid-ampullaceous, hyaline or pale grayish yellow in KOH, *dermatobasidia* present.

Habitat: Gregarious under *Pinus occidentalis*.

Known distribution: Eastern Canada south to Georgia and west to Minnesota in North America; the Dominican Republic in the Caribbean.

Material examined: DOMINICAN REPUBLIC. La Vega Province: Valle Nuevo, virgin pine stand, 18°47'0"N, 70°37'40"W, 2200 m asl, 31 July 1996, *DJL-DR-1,* DR 128 (JBSD, CFMR).

Notes: *Tylopilus chromapes* is distinguished by the pink colors over the pileus, stipe and hymenophore surfaces and by the bright yellow color of the surface and context of the stipe base. Our collection is an old specimen of this species, but it agrees with those described by Smith and Thiers (1971), differing only in the shape of the pleurocystidia, which is hyphoid rather than fusoid ventricose. A similar species to *T. chromapes* is *Leccinum cartagoense* (Wolfe & Bougher) Halling & Mueller reported from Costa Rica (Halling and Mueller, 2003), but its pink colors are not very intense and vanish with time and it has shorter basidiospores (11.2-14 µm vs. 13.6-17.8 µm).

46. ***Tylopilus violatinctus*** T.J. Baroni & Both, Bull. Buffalo Soc. Nat. Sci. 36: 261 (1998). (Figs 89, 95)

Pileus 42-102 mm diam., broadly convex to convex, felty, grayish ruby (12D5), to grayish Magenta (14D4) to purplish gray (14D2), bruising dark purple (14F8), pale brown in KOH, negative in NH_4OH; margin incurved becoming plane to decurved, forming a small sterile band. *Context* soft, solid, white bruising Light Russet Vinaceous (7C4-8C3), pink to brown in KOH, negative in NH_4OH. *Odor* farinaceous or fragrant. *Taste* sour or slightly bitter. *Tubes* adnexed with decurrent tooth, 1-9 mm long, whitish cream, bruising Cinnamon (5C4), becoming Mikado Brown (6D4-5), yellowish brown in KOH, negative in NH_4OH; *pores* circular or nearly so, compound, 1-3/mm, whitish cream, bruising Clay Color (5D5) becoming Mikado Brown (6D4-5). *Stipe* 52-82 mm long, 15-33 mm wide at apex, 36-37 mm at middle, 24-32 mm at base, subequal, slightly ventricose, smooth, white at apex and base, otherwise pale grayish vinaceous to Light Russet Vinaceous (7C4-8C3) becoming Walnut Brown (8E5), yellowish brown in KOH, negative in NH_4OH. *Context* soft, solid, white, bruising Light Russet Vinaceous (7C4-8C3), negative in KOH and NH_4OH. *Basal mycelium* white. *Spore print* not obtained.

Basidiospores 5.6-8 × 3.2-4.8 µm (n = 20; 7.36 ± 0.76 × 3.88 ± 0.39; Q_m = 1.91 ± 0.2), ellipsoid, few, grayish green in KOH. *Basidia* 25.6-29.6 × 8 µm, clavate, 4-sterigmate. *Basidioles* 14.4-18.4 × 4-8 µm, clavate. *Pleurocystidia* 24-39.2 × 5.6-6.4 µm, fusoid, fusoid-ventricose, hyaline or melleous in KOH, some encrusted as chrysocystidia, which are dextrinoid in Melzer's.

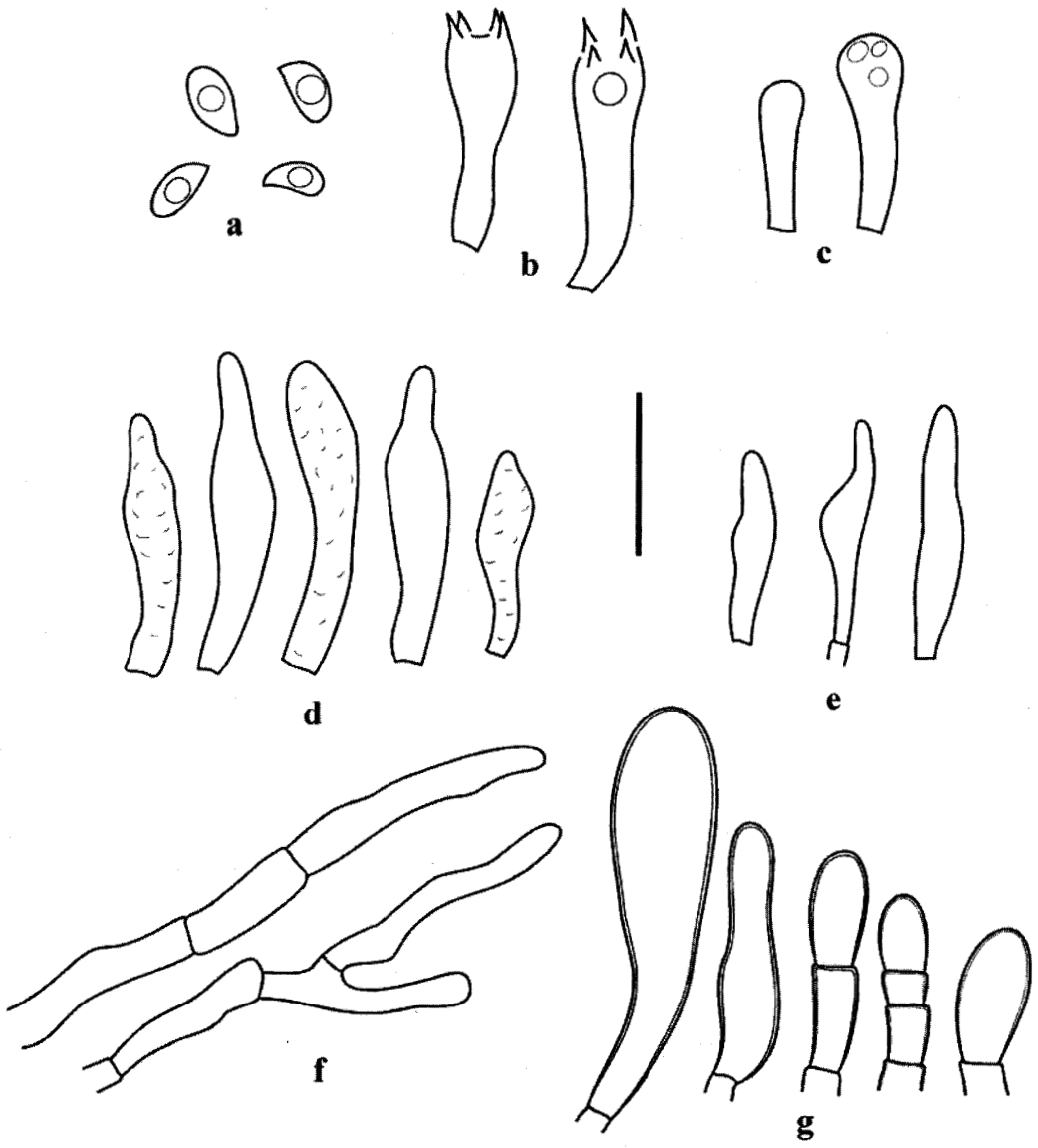


Fig. 89. *Tylopilus violatinctus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 484*. Scale bar = 20 µm.

Cheilocystidia 21.6-29.6 × 4.8 µm, fusoid. *Pileipellis* a loosely entangled layer of repent to suberect hyphae 3.2-7.2 µm diam., branched, thin to moderately thick-walled, grayish yellow or with golden yellow or bright yellowish brown contents in KOH, dextrinoid in Melzer's; end cells cylindrical, short, some with a subcapitate apex. *Stipitipellis* hyphae 3.2-16.8 µm diam., interwoven, subgelatinous, hyaline or grayish yellow in KOH, in some areas with yellowish

brown or golden brown encrusted pigments. *Caulocystidia* 8.8-53.6 × 7.2-15.2 µm, clavate, fusoid, ventricose, mostly thick-walled, with pale yellowish brown contents in KOH; *dermatobasidia* present.

Habitat: Gregarious or caespitose under *Quercus* spp.

Known distribution: New York, Pennsylvania and Mississippi in North America; Belize and Costa Rica in Central America.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, near Forestry Station cabins, 16°58'23"N, 89°59'39"W, 450 m asl, 1 December 2002, *BOS 484,* BZ 2412 (BRH, CFMR).

Notes: *Tylopilus violatinctus* is distinguished by the violet colors over the pileus surface that become rusty violet or dark violet when bruised, the lilac stipe, pink hymenophore that becomes brown with time, and the very bitter taste. While there are several species of *Tylopilus* with violaceous colors, our collection most closely matches *T. violatinctus* described by Baroni and Both (1998). Our collection differs from *T. violatinctus* by the tubes that are adnexed with a decurrent tooth rather than deeply depressed with a short decurrent tooth and by the caulocystidia that are thick-walled rather than thin-walled. *Tylopilus plumbeoviolaceus* Snell & E.A. Dick and *T. rubrobrunneus* Mazzer & A.H. Sm. have longer basidiospores (10-13 and 10-14 µm, respectively, vs. 5.6-8 µm) and do not stain rusty violet on the pileus surface. *Tylopilus williamsii* Singer & García has somewhat longer basidiospores (7.5-11 vs. 5.6-8 µm), the color of the dried pileus is grayish yellowish brown rather than pinkish brown and the stipe color is white or yellow with brown spots rather than Light Russet Vinaceous (7C4-8C3) to Walnut Brown (8E5).

Genus *Xerocomus* Quél.

47. ***Xerocomus belizensis*** B. Ortiz & T.J. Baroni, **sp. nov.** (Figs 96, 102)

MycoBank: 511059

Etymology: *belizensis* - from Belize.

Pileus fibrilloso-tomentosus demum rimoso-areolatus, flavido-brunneus. *Contextus* citrinus vel albus, immutans. *Tubi* adnato-decurrentes, tristis, aureo-flavidi, *pori* concolores. *Stipes* subtiliter pruinosus, flavido-brunneus, sursum reticulatus.

Pileus 40-60 mm diam., convex to plane, matted fibrillose to tomentose, soft, dry, becoming rimose-areolate at disc, yellow brown (6C-D4), staining slowly mahogany brown in NH_4OH; margin irregularly undulate. *Context* pale lemon yellow or white, unchanging; 10 mm thick at center. *Odor* not distinctive. Taste *mild*. *Tubes* adnate or short decurrent, 7 mm long, dull golden yellow to tan; *pores* radially elongated near stipe, angular elsewhere, 2-3/mm, concolorous with tubes, unchanging. *Stipe* 20-40 mm long, 10 mm wide, tapered sharply to base (base pinched), finely pruinose overall, some with a reticulum in upper half, others with a reticulum just at apex, concolorous with

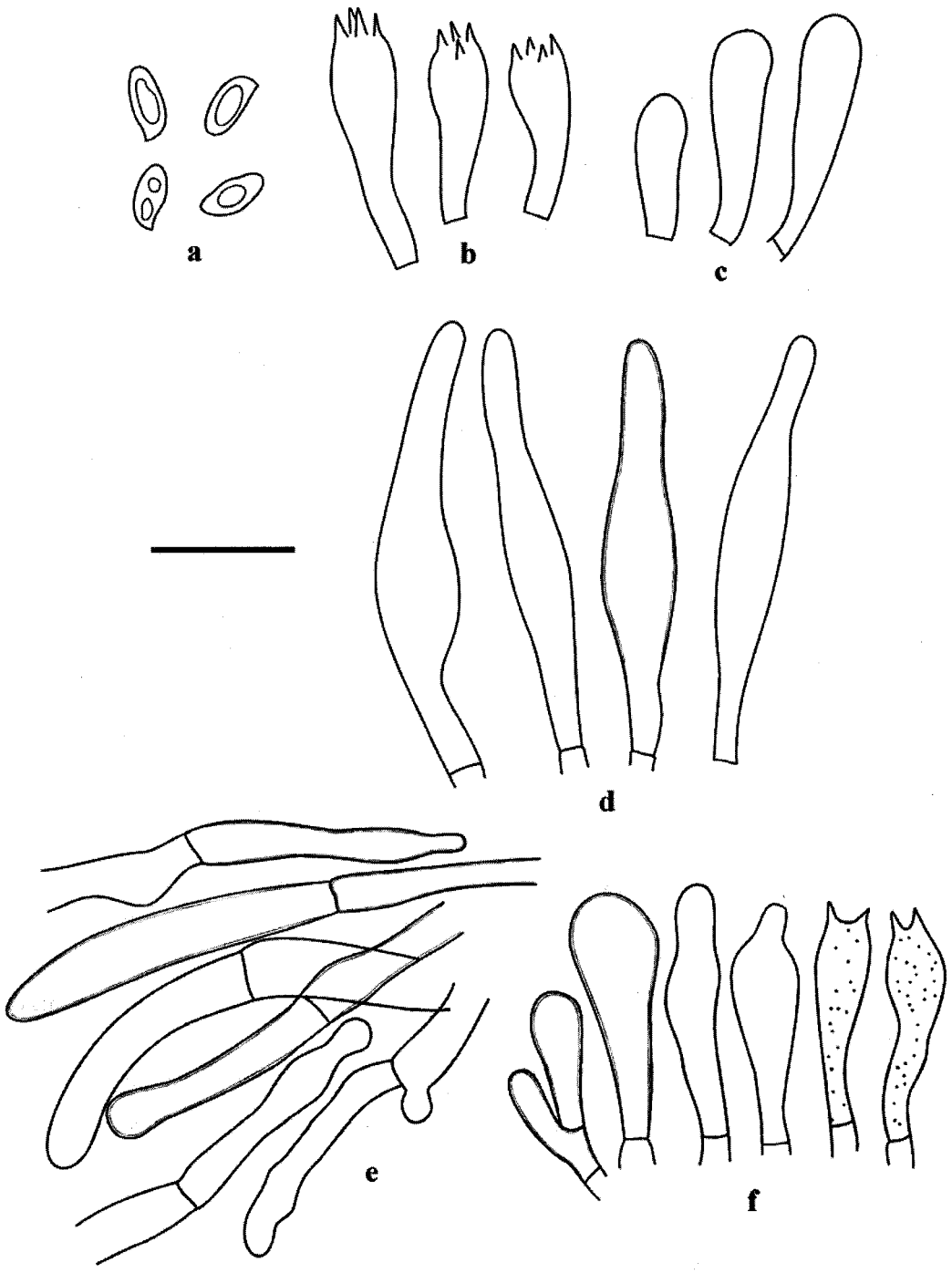


Fig. 96. *Xerocomus belizensis*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** End-cells of pileipellis; **f.** Caulocystidia and dermatobasidia. *TJB 9400*. Scale bar = 20 µm.

pileus with brown pruina. *Context* pallid becoming tan or red mainly near base. *Spore print* not obtained.

Basidiospores 9.6-12 × 4-4.8 µm (n = 20; 10.44 ± 0.92 × 4.68 ± 0.29; Q_m = 2.24 ± 0.19), ellipsoid, smooth, grayish yellowish green in KOH, grayish yellow or dextrinoid in Melzer's solution. *Basidia* 24-36 × 8.8-9.6 µm, clavate, 4-sterigmate. *Basidioles* 20-34 × 6.4-8 µm, clavate. *Hymenial cystidia* 60.8-66.4 × 8-8.8 µm, present mainly on sides, fusoid with elongated neck, some moderately thick-walled. *Pileipellis* a tangled layer of repent to suberect hyphae 4-12 µm diam., subgelatinous in some areas, thin- to moderately thick-walled; encrusted pigments yellowish brown in H_2O, diffusing a golden yellow color after the application of KOH; pale grayish yellow in KOH, grayish golden yellow in Melzer's; end cells mainly cylindrical (some with acute or capitated apex), few broadly clavate. *Stipitipellis* hyphae 2.4-10.4 µm, interwoven, hyaline to very pale grayish yellow in KOH, giving rise to clusters of *Caulocystidia*; these 18-49.6 × 4-14.4 µm, clavate, fusoid-ventricose, cylindric, some with an elongated neck, numerous, in clusters, thin- to moderately thick-walled, grayish yellow in KOH; numerous dermatobasidia present at stipe apex, those 25-32 × 8-9.6 µm, with granules and yellowish brown contents in KOH.

Habitat: Caespitose on soil, under *Pinus caribaea* and near *Quercus peduncularis*.

Known distribution: Belize.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, Forestry Station, 16°58'23"N, 88°59'37"W, 450 m asl, 14 October 2002, *TJB 9400,* BZ 2120 (CORT, **holotype**; BRH, CMFR, **isotypes**).

Notes: *Xerocomus belizensis* is distinguished by the yellow brown color of pileus and stipe, golden yellow adnate or short decurrent hymenophore and pale lemon yellow to white context that does not bruise blue, a reticulum on the stipe, ellipsoid spores and thick-walled pileipellis hyphae and caulocystidia. It resembles *Bothia castanella* (Peck) Halling, T. J. Baroni & Manfr. Binder by the type of tube attachment, radial elongation of pores, color of tubes/pores, and the shallowly reticulate stipe, but this species differs in several aspects (Halling *et al.*, 2007). The pileus of *B. castanella* is dark brown or dark reddish brown fading to pinkish brown (Mikado Brown or Sayal Brown) instead of yellowish brown; the hymenophore color is rusty pink to cinnamon brown with pores staining brown to dark brown instead of dull golden yellow to tan and the pileipellis hyphae and caulocystidia are not thick-walled. The species delimitation in the genus *Xerocomus* is still under study. Comparisons using additional data, such as DNA sequences are needed to better understand the placement of this species.

48. ***Xerocomus olivaceus*** B. Ortiz & T.J. Baroni, **sp. nov.** **(Figs 97, 103)**
MycoBank: 511060

Etymology: *olivaceus* - referring to the olive tint on the pileus and stipe surfaces, and the deep olive green hymenophore.

Pileus mollis, minute coactus, fibrillose-squamulosus, cinereo-alutaceus vel sordide cremeus. *Contextus* flavus, tarde caeruleus. *Tubi* adnati, leviter decurrentes, olivaceo-viridi, *pori* concolores. *Stipes* aequus, pruinosus, sursum flavus, deorsum olivaceo-brunneus, intus flavus, obscure rhabarbarinus in centro, olivaceo-brunneus in basim.

Pileus 40-70 mm diam., convex, soft to touch, finely felty or fibrillose-squamulose, or with erect scales, finely areolate over margin on the oldest one, ground color grayish tan (5C4) to sordid cream with grayish orange (5B3), olive brown (5D-E5-6) or dark brown fibrils and tomentum, cracks showing cream color, appearing to stain purplish brown where bruised; margin not projecting. *Context* bright yellow (2A2-3A3-4) in young ones, slowly bluing when exposed, irregularly but distinctly, fading with exposure to a dingy brown yellow; 8-14 mm thick at center. *Odor* not distinctive. *Taste* nutty or not distinctive. *Tubes* adnate with slightly decurrent tooth, 8-11 mm long, deep olive green (3B6 to 4C5-6), not bruising; *pores* angular, 1-2/mm, concolorous with tubes. *Stipe* 30-40 mm long, 4-8 mm wide, equal or tapered to base or enlarged at base, pruinose, more or less concolorous with pileus; ground color yellow at apex, olivaceous brown (5C3-5D4) below with dark brown or reddish brown pruina. Context with a mixture of yellow as in pileus, dull rhubarb in middle, deep olive brown in base. NH_4OH negative in pileipellis, context and tubes. *Basal mycelium* grayish ashy or concolorous with surface. *Spore print* not obtained.

Basidiospores 11.2-12.8 × 4.8 µm ($n = 20$; 11.88 ± 0.6 × 4.8; $Q_m = 2.48 \pm 0.12$), ellipsoid, smooth, yellowish brown with dark brown wall in KOH, yellowish brown to dextrinoid in Melzer's. *Basidia* 27.2-34.4 × 8-11.2 µm, clavate, 4-sterigmate. *Basidioles* 28-36 × 7.2-11.2 µm, clavate. *Hymenial cystidia* 40-72 × 6.4-12 µm, fusoid ventricose or fusoid-ampullaceous. *Pileipellis* a tangled layer of repent and erect hyphae 4.8-26.4 µm diam., some inflated, thin to moderately thick walled, encrusted pigments yellowish brown in H_2O, producing a pale reddish brown or red color reaction after the application of KOH, hyaline or grayish yellow in KOH; end cells 23.2-52.8 × 10.4-20.8 µm, multi-septate, elements cylindrical or clavate, some with acute apex. *Stipitipellis* hyphae 4.8-12.8 µm diam., elongated, interwoven, hyaline in KOH, with yellow or yellowish brown contents in Melzer's. *Caulocystidia* 28-55.2 × 4.8-13.6 µm, cylindrical, fusoid or fusoid ventricose.

Habitat: Gregarious or caespitose on sandy soil under *Coccoloba uvifera*.

Known distribution: Belize.

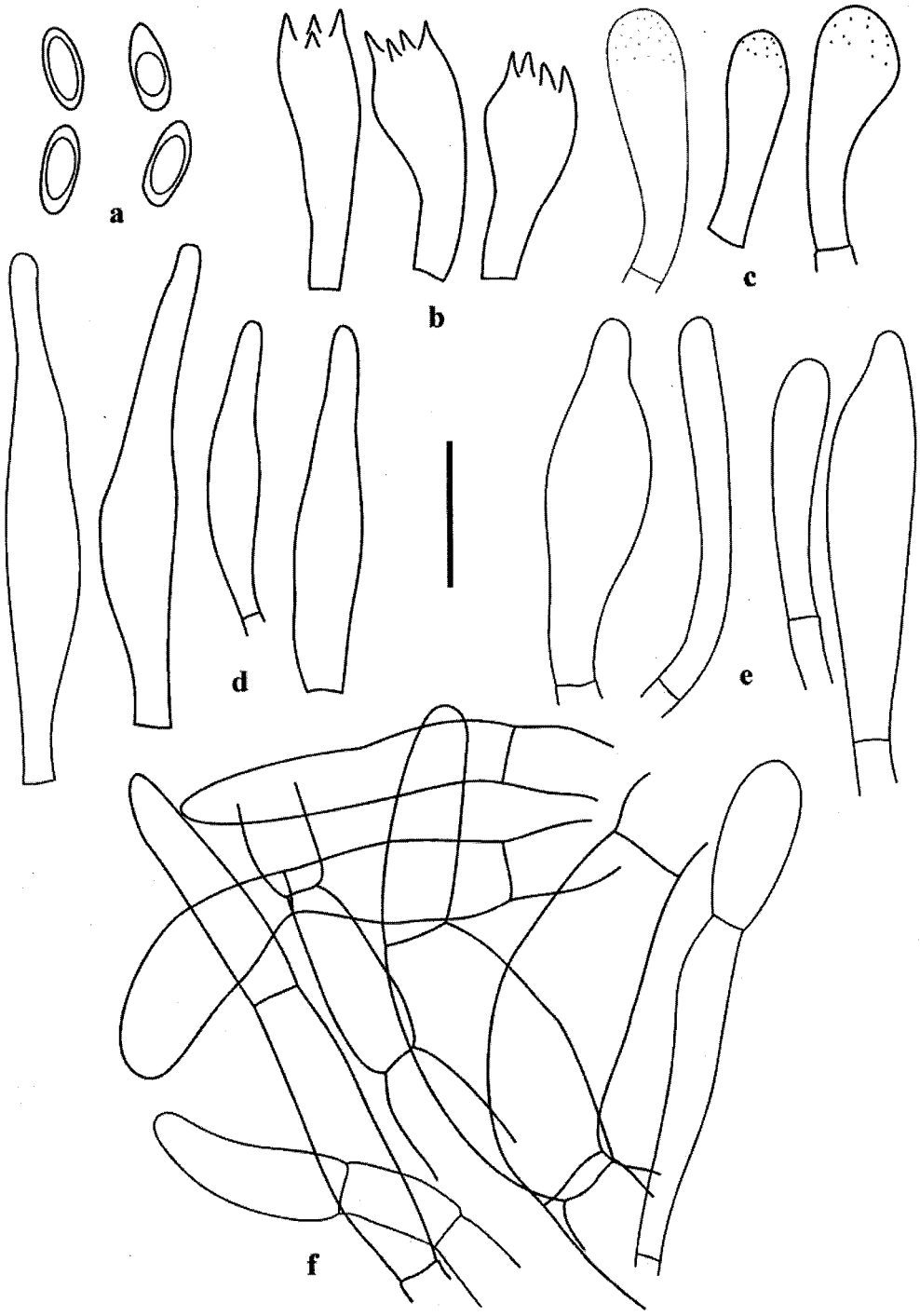


Fig. 97. *Xerocomus olivaceus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** Caulocystidia; **f.** End-cells of the pileipellis. *TJB 9943.* Scale bar = 20 µm.

Material examined: BELIZE. Belize District: Ambergis Caye, South Beach Road from San Pedro, 17°54' 10.1"N, 87°58'35.7"W, 3 m asl, 21 November 2004, *TJB 9943*, BZ 3953 (CORT, **holotype**; BRH, CFMR, **isotypes**).

Notes: *Xerocomus olivaceus* is distinguished by the olive brown to grayish tan pileus, the areolate surface showing cream color in the cracks, yellow context that does not bruise blue, a deep olive green hymenophore, a pruinose stipe with yellow ground color and olivaceous or reddish brown pruina and no reaction in any part with the application of NH_4OH. In addition, this taxon was associated with *Coccoloba uvifera* (*Polygonaceae*) as the host plant. Some of these characteristics indicate it belongs to Section *Xerocomus*, but it does not resemble any previously described species. As mentioned above for *X. belizensis*, further analysis is necessary to obtain a better understanding of this species classification.

Ectomycorrhizal fungi associated with tropical dicotyledonous plants are generally not associated with pines or other temperate floristic elements. Another species of *Xerocomus* associated with *C. uvifera*, *X. coccolobae* Pegler, was described from the island of Martinique in the Lesser Antilles and it has since been found in the British Virgin Islands. While *X. coccolobae* has similar spore dimensions as *X. olivaceus* (10-12 x 4.3-5.3 µm versus 11.2-12.8 × 4.8 µm), it differs from the latter in having a deep chestnut brown pileus and stipe surfaces with purple tints rather than olive brown or grayish tan, a pileus surface that is velutinous rather than finely felty to fibrillose-squamulose and a fibrillose-striate rather than pruinose stipe, and white rather than ashy gray or olive brown basal mycelium. *Xerocomus guadelupae* (Singer & Fiard) Pegler is another species that is probably associated with *Coccoloba* spp. in the Lesser Antilles and Virgin Islands, but it resembles *X. coccolobae* rather than *X. olivaceus* and has shorter basidiospores (6.5-8 x 4-5 µm).

49. ***Xerocomus pseudoboletinus*** (Murrill) Singer, Farlowia 2: 290 (1946). (Figs 98, 104)

Synonyms:
Ceriomyces pseudoboletinus Murrill, Lloydia 7 (4): 324 (1945).
Boletus pseudoboletinus (Murrill) Murrill, Lloydia 7 (4): 326 (1945).

Pileus 15-44 (-55) mm diam., broadly convex, one slightly indented, slightly depressed at center; tomentose, becoming rimulos, Cinnamon (5C4), Orange Rufous (7C6-7), Pratt's Rufous (8D8), Kingfisher Rufous (7D8) or deep orange brown (6D6-8), deep green flash in NH_4OH on fresh material, reddish brown to brown in NH_4OH on dried material; margin inrolled with a sterile flap. *Context* Sulfur Yellow, Spectrum Yellow (3A8) or bright lemon yellow, unchanging after bruising; up to 13 mm thick at center. *Odor* none or fungoid. *Taste* mild to nutty. *Tubes* adnate or decurrent with long decurrent

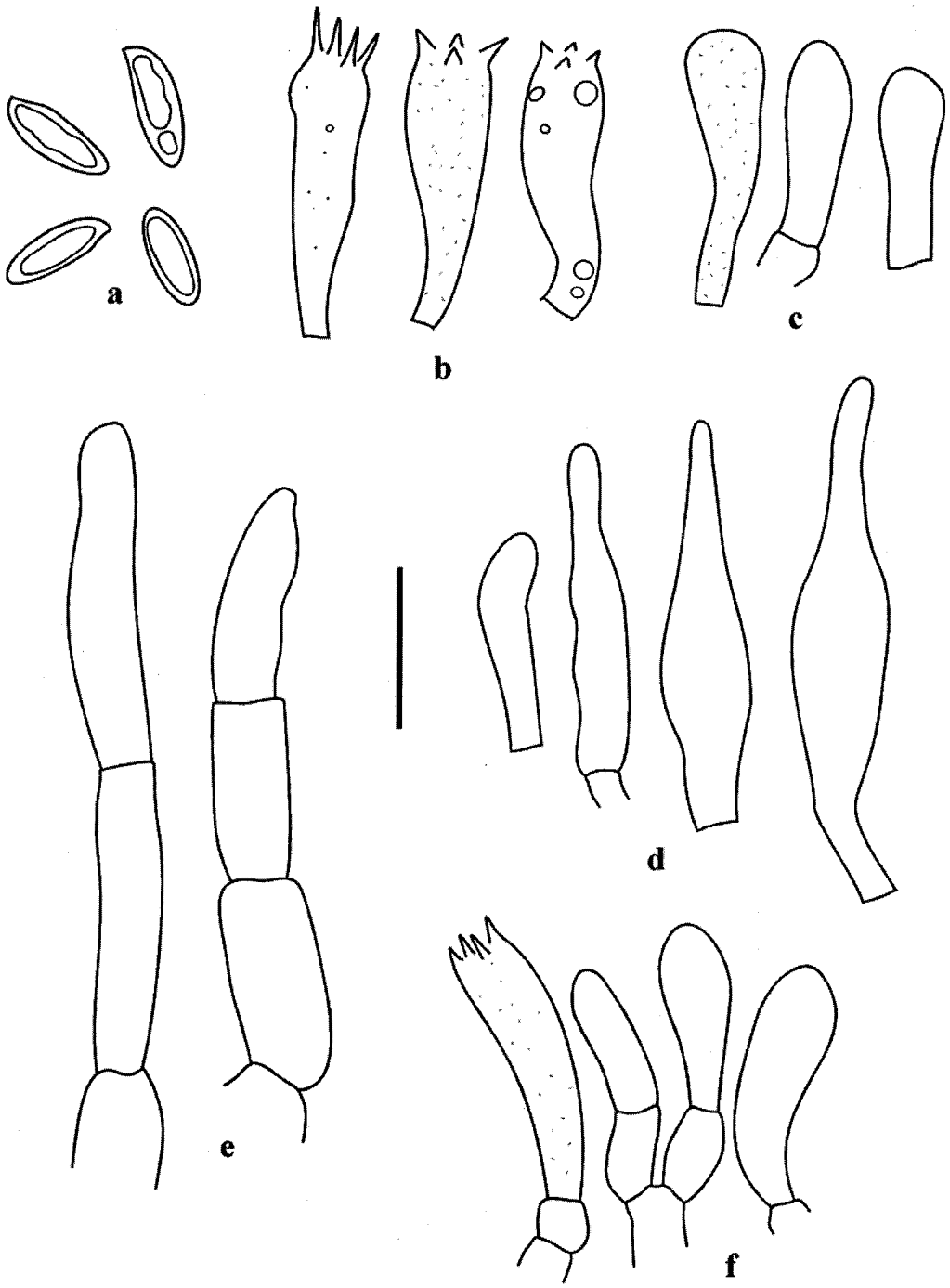


Fig. 98. *Xerocomus pseudoboletinus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** Elements of the pileipellis; **f.** Caulocystidia and dermatobasidium. *DJL-BZ-62*. Scale bar = 20 μm.

tooth, 3-6 mm long, slightly Spectrum Yellow (3A8), becoming Olive Yellow (2C5) in age, slowly deep blue green in NH_4OH; *pores* subangular to angular, 1-2/mm, concolorous with tubes. *Stipe* 12-24 (-50) mm long, 6-13 (-15) mm wide, equal or slightly clavate, pruinose overall, dull, moist; ground color bright yellow or Spectrum Yellow (3A8) with yellow or brown or Orange Rufous pruina, bruising or becoming vinaceous brown or Orange Rufous (7C6-7) to base. *Context* Spectrum Yellow (3A8), unchanging. *Basal mycelium* white or pale yellow with yellowish brown or grayish yellow areas. *Spore print* not obtained.

Basidiospores 10.4-12.8 (-14.4) × 4-4.8 µm (n = 20; 12.64 ± 1.15 × 4.48 ± 0.40; Q_m = 2.83 ± 0.25), fusiform, pale yellowish brown with dark brown wall in KOH, yellowish brown or reddish brown in Melzer's. *Basidia* 28-36 (-44) × 8-10.4 µm, clavate, some with yellowish brown contents in KOH, 4-sterigmate. *Basidioles* 24-34.4 × 7.2-10.4 µm, clavate. *Hymenial cystidia* (24-) 25.8-64 × 5.6-11.2 µm, fusoid-ampullaceous, fusoid-ventricose or fusoid. *Pileipellis* a tangled layer of repent to suberect hyphae 4-14.4 (-20.8) µm diam., hyaline or with grayish golden yellow or yellowish brown contents in KOH, bright orange brown or grayish golden yellow in Melzer's; end cells multi-septate, elements cylindrical, clavate or broadly clavate, some inflated. *Stipitipellis* hyphae 3.2-14.4 µm diam., hyaline in KOH; *caulocystidia* 14.4-29.6 × 4.8-9.6 µm, clavate; *dermatobasidia* 28.8-32 × 8-9.6 µm, yellowish brown in KOH.

Habitat: Gregarious on sandy soil under *Pinus caribaea*, *Quercus peduncularis* and *Quercus* spp.

Known distribution: Florida in North America; Belize and Nicaragua in Central America.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Hidden Valley, road to Five Sisters Lodge from Hidden Valley, 17°2'N, 88°54'47"W, 456 m asl, 9 August 2001, *DJL-BZ-62,* BZ 62 (BRH, CFMR); Five Sisters Lodge, near fork in entrance road to Lodge, 17°2'20.2"N, 88°58'16.2"W, 380 m asl, 8 August 2001, *DJL-BZ-52*, BZ 52 (BRH, CFMR); *TJB 9118.1*, BZ 306 (CORT, CFMR); *TJB 9120*, BZ 308 (CORT, CFMR).

Notes: *Xerocomus pseudoboletinus* is characterized by the mahogany brown, to Mikado Brown or tawny brown pileus surface that becomes blue green with the application of NH_4OH, a yellow context unchanging or more rarely greening after bruised, a yellow hymenophore unchanging or staining blue after bruised, a stipe with yellow or brown pruina and a white basal mycelium. *Xerocomus pseudoboletinus* belongs to Section *Pseudophyllopori* and is similar to *X. hypoxanthus* Singer, the latter is distinguished by the small and thin fruiting bodies and a by the distinctly bright yellow stipe base. Our collections differ from those described by Singer (1945b) and Singer *et al.*

(1983) in having smaller fruiting bodies and the basal mycelium is white to pale yellow.

Suborder *Boletineae* Rea emend. E.-J. Gilbert
Family *Strobilomycetaceae* E.-J. Gilbert
Genus *Strobilomyces* Berk.
50. ***Strobilomyces confusus*** Singer, Farlowia 2: 108 (1945). (Figs 99, 105)

Pileus 45 (-87) mm diam., convex, with squarrose scales; ground color cream to grayish brown with black or Sepia (5A1-2) scales; margin appendiculate forming a sterile flap, 3 mm wide. *Context* white to pinkish white, bruising Burnt Orange (8B8) to reddish brown then becoming black. *Odor* not distinctive or fungoid. *Taste* mild. *Tubes* adnexed to depressed near stipe, 5-13 (-22) mm long, grayish brown, bruising fuscous; *pores* circular to nearly so, 1-2/mm, grayish brown. *Stipe* 62 (-80) mm long, 5-16 mm wide, equal with a bulbous base, appressed fibrillose-squamose, slightly reticulate at apex; ground color grayish brown with black fibrils. *Context* pale pink, bruising reddish brown. *Spore print* not obtained. *Macro-chemical reactions* not obtained.

Basidiospores 8.8-10.4 (-12.8) × 8.2-9.6 (-11.2) µm (n = 20; 10.67 ± 1.14 × 9.6 ±; 0.72, Q_m = 1.10 ± 0.02), globose with irregular sparassoid ornamentations forming a partial network, dark yellowish brown in KOH. *Basidia* 20.8-44 × 11.2-16.8 µm, clavate, (2-) 4-long sterigmate, some with grayish yellowish brown or yellowish brown contents in KOH. *Basidioles* 21.6-37.6 × 8-10.4 µm, clavate. *Hymenial cystidia* scattered, 27.2-61.6 × 12.8-18.4 µm, clavate, clavate-mucronate, fusoid-ampullaceos, hyaline or with pale grayish brown or yellowish brown contents in KOH. *Pileipellis* a trichodermium of erect hyphae 4-16.8 (-20.8) µm diam., parallel, interwoven in some areas, multi-septate, thin to moderately thick-walled, with dark brown contents in KOH; end cells cylindrical or clavate, short to elongated. *Stipitipellis* hyphae 4.8-18.4 µm diam., some thick-walled; contents bright yellowish brown to orange brown or orange in KOH. *Caulocystidia* 21.6-53.6 × 8-15.2 µm, clavate, cylindrical or cylindric-clavate, some thick-walled.

Habitat: Solitary under *Pinus caribaea*, *P. occidentalis* and *Quercus* spp.

Known distribution: Eastern Canada to Florida, west to Minnesota and Texas and south to Mexico in North America; Belize and Costa Rica in Central America; Colombia in South America; the Dominican Republic in the Caribbean.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, 1000 Foot Falls, Hidden Valley, Butterfly Falls trail, 17°3'46.2"N, 88°52'22.2"W, 583 m asl, 10 January 2002, *BOS 184,* BZ 872 (BRH, CFMR); Douglas da Silva, swamp near British Military Camp, 16°58'8.9"N, 88°59'38.4"W, 450 m asl, 9 January 2002, *OKM 27963*, BZ 684

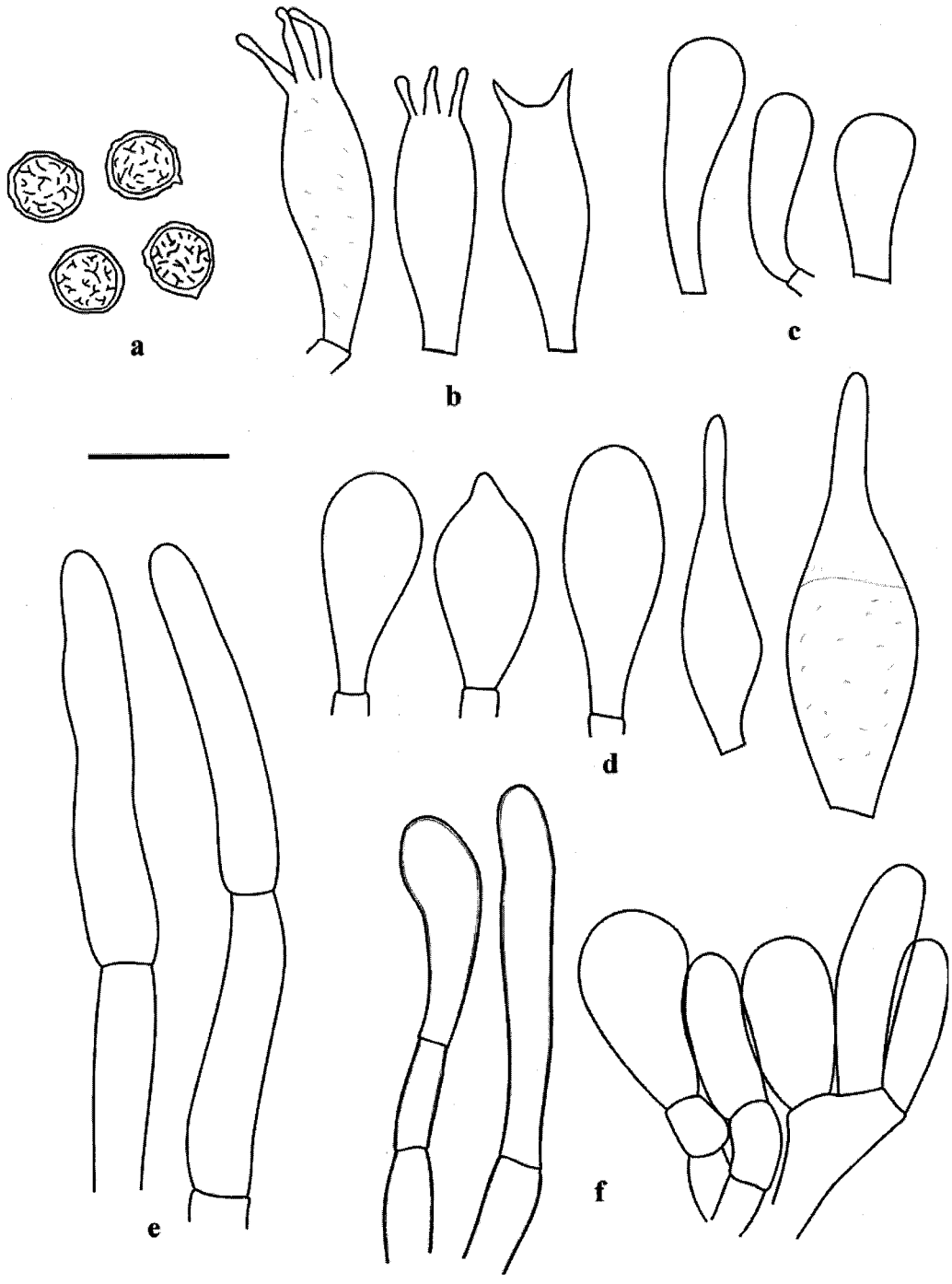


Fig. 99. *Strobilomyces confusus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** End-cells of pileipellis; **f.** End-cells of stipitipellis and caulocystidia. *BOS 184.* Scale bar = 20 μm.

(CFMR, VPI); 3 October 2003, *REH 8514*, BZ 3294 (CFMR, NY, VPI). DOMINICAN REPUBLIC. Santiago Province: La Celestina, Plan Sierra Community Forest, 19°23'17"N, 71°1'57"W, 550 m asl, 27 January 1988, *DJL-DR-11*, DR 555 (JBSD, CFMR); 23 November 1999, *DJL-DR-24*, DR 1017 (JBSD, CFMR); 10 January 2002, *DJL-DR-58*, DR 2161 (JBSD, CFMR).

Notes: *Strobilomyces confusus* is distinguished by the gray to black colors over the basidiocarp, squarrose scales, a pale pink context that bruises quickly to red and then black and spores with "sparassoid" ornamentation (Halling, 1989), resembling an incomplete fragmented network. Our collections agree with those described by Singer (1945a).

51. ***Strobilomyces strobilaceus*** (Scop.: Fr) Berk., Hook. J. Bot. 3: 78 (1851). (Figs 100, 106)

Synonyms:
Boletus strobilaceus Scop.: Fr., Annus Hist.-Nat. 4: 220 (1770).
Boletus floccopus Vahl: Fr., Fl. Dan. 7: t.1252 (1799).
Strobilomyces floccopus (Vahl: Fr.) P. Karst., Bidr. Finl. Nat. Folk 37: 16 (1882).
Eriocorys strobilacea (Scop.: Fr.) Quél., Enchir. Fung., p. 163 (1886).
Eriocorys strobilacea var. *floccopus* (Vahl: Fr.) Quél., Enchir. Fung., p. 163 (1886).

Pileus 19-63 mm diam., broadly conical to convex, with uplifted squamose to wooly scales; ground color whitish gray to pale gray with Hair Brown (5F5) to Sepia (5A1-2) scales, bruising red on the ground and black on scales, reddish brown in KOH, negative in NH_4OH; margin decurved, appendiculate. *Context* soft, white bruising Ferrugineous (8C-D6-7) to Chestnut (10E6), becoming black, pale yellow in KOH, negative in NH_4OH, blue in $FeSO_4$; 15 mm thick at center, 3 mm at margin. *Odor* of bread. *Taste* mild or slightly bitter. *Tubes* adnexed to adnate, 15 mm long, Smoke Gray (5D3), bruising reddish brown to Chestnut (10E6), reddish black in KOH, black in NH_4OH, dark blue in $FeSO_4$; *pores* angular, 1-2/mm, Smoke Gray (5D3), bruising reddish brown to black. *Stipe* 50-82 mm long, 8-9 mm wide at apex, 9-10 mm at middle, 8-14 mm at base, clavate to tapered at base, strongly reticulate at apex or overall, floccose below; ground color whitish gray to Cinnamon Drab (7D4) with black ornaments, bruising Sepia (5A1-2); reddish brown in KOH, negative in NH_4OH, black in $FeSO_4$. *Context* fibrous, white, bruising Tawny (6-7D7) to Ferrugineous (8C-D6-7) to blackish red, brown in KOH, negative in NH_4OH. *Spore print* not obtained.

Basidiospores 9.6-12.8 × 9.6-11.2 µm (n = 20; 11.42 ± 1.14 × 10.16 ± 0.53; Q_m = 1.12 ± 0.08), short-ellipsoid to globose, ornamented with a complete reticulum or network. *Basidia* 32-40 × 12-12.8 µm, clavate, (2-) 4-sterigmate. *Basidioles* 28-34.4 × 10.4-12 µm, clavate, some with golden yellow contents in KOH. *Hymenial cystidia* 40-56 × 11.2-16 µm, fusoid ventricose, clavate, some thick-walled, with yellowish brown contents in KOH. *Pileipellis* a

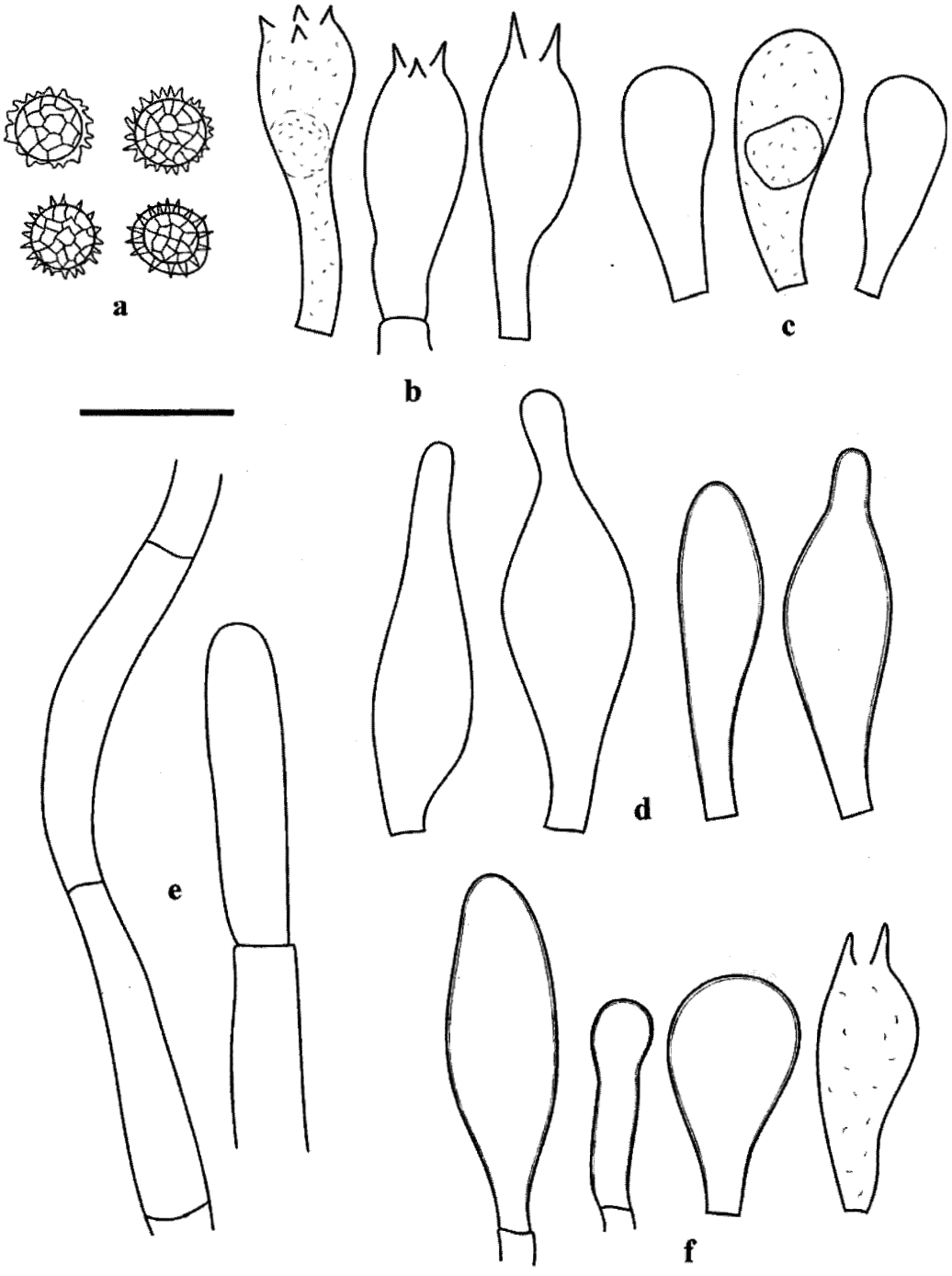


Fig. 100. *Strobilomyces strobilaceus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** Elements of the pileipellis; **f.** Caulocystidia and dermatobasidia. *BOS 371.* Scale bar = 20 µm.

trichodermium of erect hyphae 4-13.6 µm diam., subparallel to interwoven, moderately thick-walled, with yellowish brown or pale brown contents in KOH; end cells cylindrical. *Stipitipellis* hyphae 3.2-11.2 µm diam., parallel, interwoven in some areas, subgelatinous in others, with yellowish brown, orange brown or brown contents in KOH. *Caulocystidia* 25.6-45.6 × 7.2-16.8 µm, few, in clusters, clavate, obpyriform, broadly ventricose, some thick-walled, some with yellowish brown contents in KOH; *dermatobasidia* present.

Habitat: Solitary under *Pinus caribaea*.

Known distribution: Eastern Canada to Florida, west to Wisconsin and Arizona and south to Mexico in North America; Belize and Costa Rica in Central America; Cuba in the Caribbean.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 18 October 2002, *BOS 371,* BZ 1720 (BRH, CFMR).

Notes: *Strobilomyces strobilaceus* is distinguished by the white ground color with gray to black scales over the pileus and stipe surfaces, a context bruising red and then black, and spore ornamentation with an unbroken network; the latter is the main feature that differentiates it from *S. confusus*. Our collection agrees with those described by Singer (1945a).

Suborder *Sclerodermatineae* Manfr. Binder & Bresinsky

Family Gyroporaceae (Singer) Manfr. Binder & Bresinsky

Genus *Gyroporus* Quél.

52. ***Gyroporus castaneus*** (Bull.: Fr.) Quél., Enchir. Fung., p. 161 (1886). (Figs 101, 107)

Synonyms:
Boletus castaneus Bull.: Fr., Herb. France 7: t.328 (1787–88).
Boletus fulvidus Fr., Observ. Mycol. 2: 247 (1818).
Suillus castaneus Poir. ex P. Karst., Bidr. Finl. Nat. Folk 37: 1 (1882).
Gyroporus castaneus var. *fulvidus* (Fr.) Quél., Enchir. Fung., p. 161 (1886).
Boletus rufocastaneus Ellis & Everh., N. Am. Fungi 2nd ser., no. 2302 (1890) (nom. nud).
Leucobolites castaneus (Bull.: Fr.) Beck, Zeitschr. Pilzk. 2: 142 (1923).
Leucobolites fulvidus (Fr.) Beck, Zeitschr. Pilzk. 2: 142 (1923).

Pileus 36-44 mm diam., convex to plane, felty, ground color Chamois (4A4) with Clay Color (5D5) to Cinnamon (5C4) hairs, not bruising, negative in KOH and NH_4OH; margin decurved with a projecting sterile band. *Context* soft, solid, white, not bruising, negative in KOH and NH_4OH; 6-8 mm thick at center, 2.5-3 mm at margin. *Odor* and *taste* not distinctive. *Tubes* adnexed, 1-3 mm long, white, not bruising, negative in KOH and NH_4OH; *pores* nearly circular, 1-2/mm, white or Pale Horn Color (4B3) becoming pale Olive Yellow (2C5) or pale brown with time, not bruising. *Stipe* 30-34 mm long, 9-12 mm wide at apex, 11-18 mm at middle, 16-18 mm at base, stuffed, developing

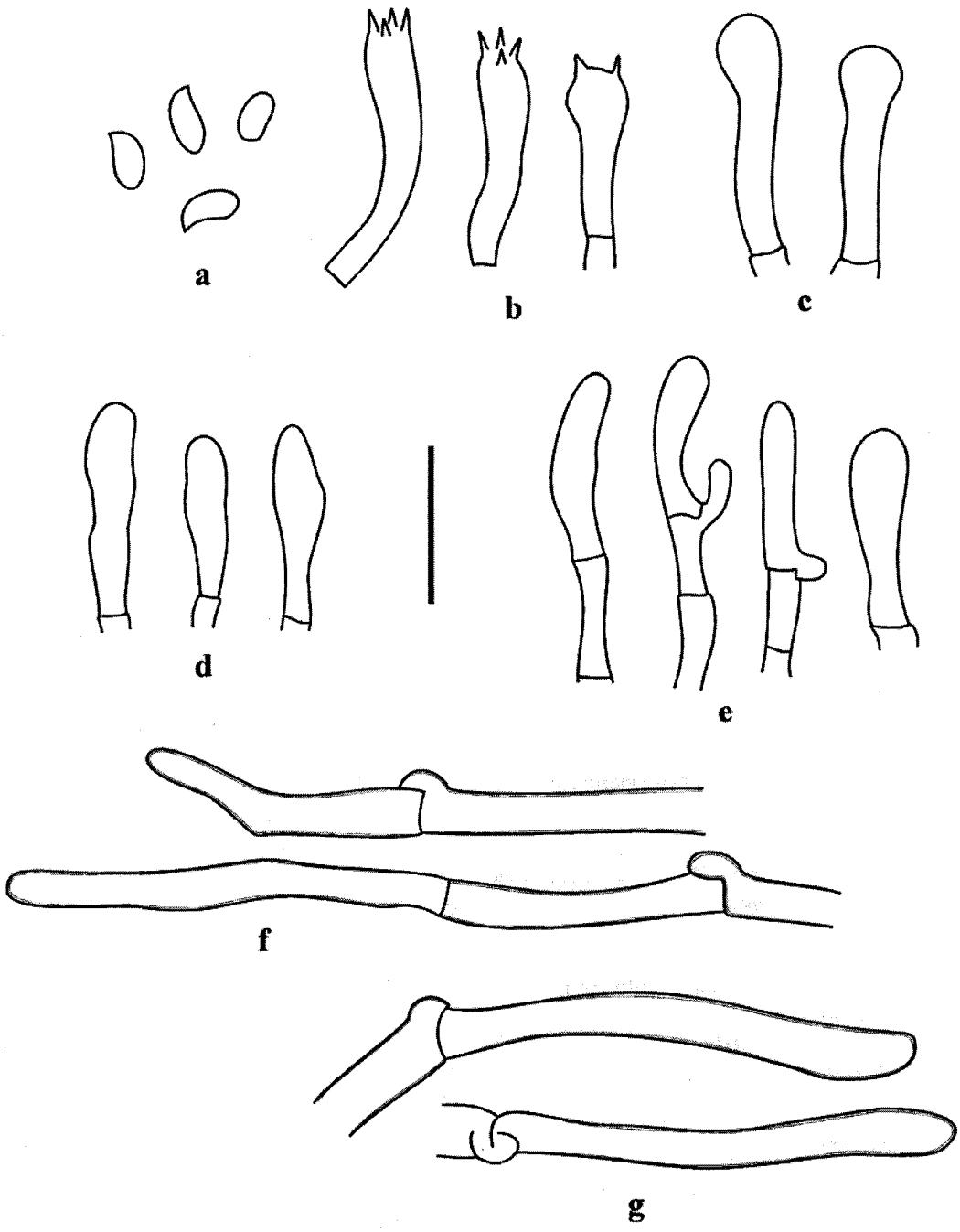


Fig. 101. *Gyroporus castaneus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** End-cells of stipitipellis. *BOS 472*. Scale bar = 20 µm.

hollow chambers in age, tapered at apex, felty, Chamois (4A4) to pale Salmon Color (6B4) becoming orange brown, not bruising, negative in KOH and NH_4OH. *Context* soft, white, not bruising, negative in KOH and NH_4OH. *Basal mycelium* white. *Spore print* not obtained.

Basidiospores 5.6-8 × 3.2-4 µm (n = 20; 7.04 ± 0.88 × 3.57 ± 0.4; Q_m = 1.99 ± 0.26), ellipsoid, hyaline in KOH. *Basidia* 20-38.2 × 5.6-6.4 µm, cylindric to clavate, (2-) 4-sterigmate. *Basidioles* 19.2-29.6 × 4-7.2 µm, clavate. *Pleurocystidia* 19.2-26.4 × 5-6.4 µm, fusoid, scattered. *Cheilocystidia* 16.8-28 × 4-7.2 µm, cylindrical to subclavate, with clamps. *Pileipellis* a tangled layer of repent to suberect hyphae 3.2-11.2 µm diam., subgelatinous in some areas, thick-walled and with clamp connections; contents golden yellow in KOH, yellowish orange in Melzer's; end cells cylindrical to fusoid. *Stipitipellis* hyphae 3.2-10.4 µm diam., interwoven with clamp connections, thick-walled, grayish yellow in KOH.

Habitat: Gregarious on soil under *Pinus caribaea*, *Quercus* spp. and *Coccoloba belizensis*.

Known distribution: Eastern Canada to Florida, west to California and south to Mexico in North America; Belize, Honduras and Costa Rica in Central America.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Five Sisters Lodge, resort grounds, 17°2'16.2"N, 88°59'8"W, 380 m asl, 28 November 2002, *BOS 472,* BZ 2399 (BRH, CFMR).

Notes: *Gyroporus castaneus* is distinguished by the yellowish brown to orangish brown pileus and concolorous stipe, a white hymenophore that becomes yellow, a stuffed stipe that becomes hollow with age, and clamped hyphae. Our collection differs from those described by Singer (1945b) in having paler and less rich pileus colors (yellow brown to cinnamon rather than orange brown or chesnut brown) and distinctly narrower and somewhat shorter basidiospores (5.6-8 × 3.2-4 µm vs. 7-11 × 4.5-6 µm).

53. ***Gyroporus* cf. *phaeocyanescens*** Singer & M.H. Ivory, Beih. Nova Hedwigia 77: 37 (1983). (Figs 108, 114)

Pileus 38 (-40) mm diam., convex, appressed squamose with flat wooly scales; Mars Brown (7F8) to Sayal Brown (6D5) from center to margin, darkening after bruising, brownish orange in KOH, brownish yellow in NH_4OH; margin appendiculate. *Context* watery, Pale Horn Color (4B3), white above tubes, bruising blue; 4 (-9) mm thick at center, 3 mm at margin. *Odor* not distinctive. *Tubes* adnexed or depressed around stipe, 2 mm long, Pale Horn Color (4B3), negative in KOH and NH_4OH; *pores* circular, 2-3/mm, Pale Horn Color (4B3). *Stipe* (25-) 35 mm long, 7 mm wide at apex, 9 (-11) mm at

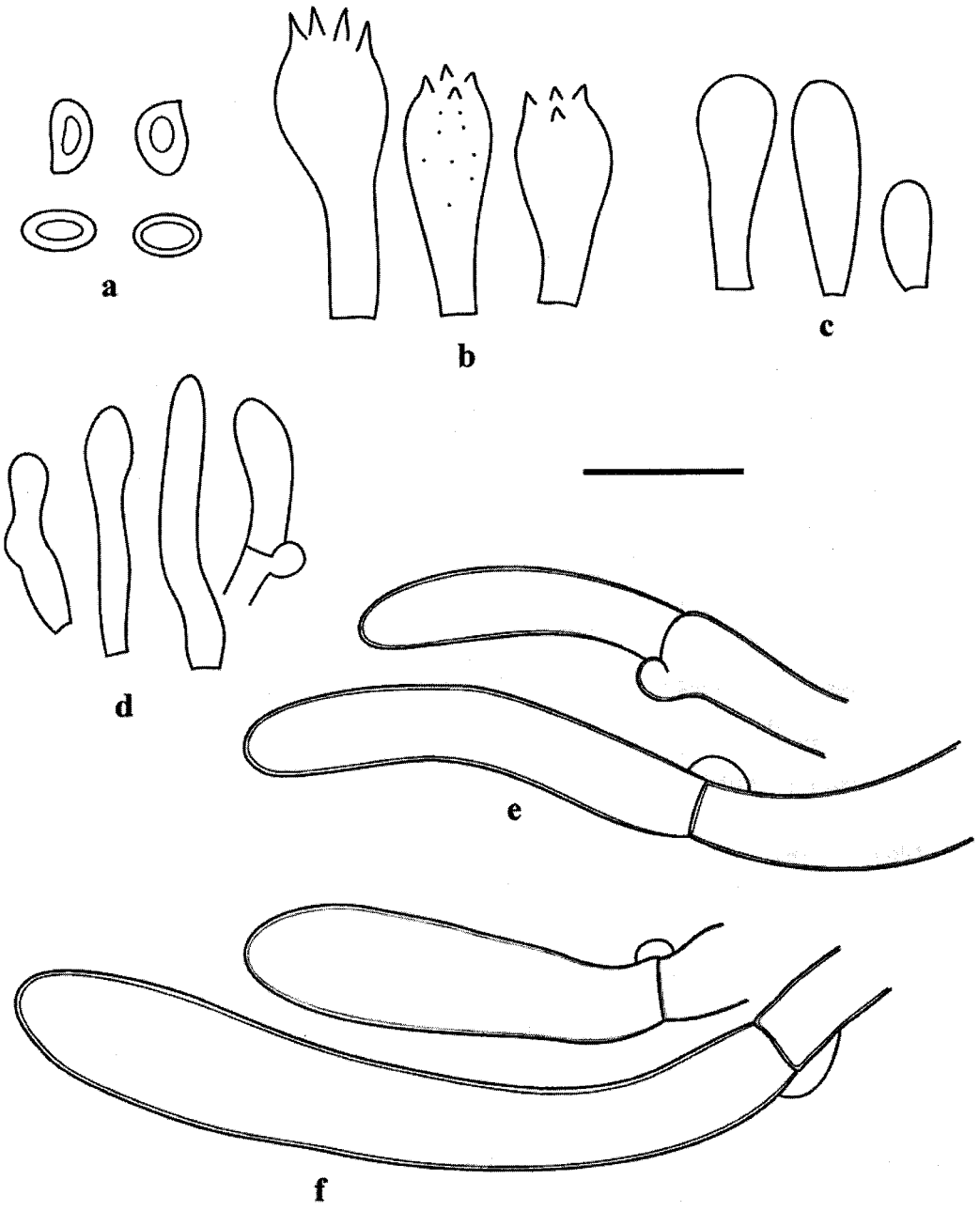


Fig. 108. *Gyroporus* cf. *phaeocyanescens*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Cheilocystidia; **e.** End-cells of pileipellis; **f.** End cells of stipitipellis. *BOS 360*. Scale bar = 20 µm.

middle, 6 (-17) mm at base, slightly ventricose to subequal or clavate, stuffed or hollow, tomentose; ground color Pale Horn Color (4B3) with Mars Brown (7F8) to Natal Brown (7F6) hairs, bruising blue in some areas and Sepia (5A1-2) in others; orange brown in KOH, orange yellow in NH_4OH, dark brown in $FeSO_4$. *Context* Tawny Olive (5C4), not bruising, yellowish brown in KOH, yellow in NH_4OH. *Spore print* not obtained.

Basidiospores 8-9.6 (-10.4) × 4.8-5.6 µm (n = 20; 8.72 ± 0.73 × 5.2 ± 0.41; Q_m = 1.68 ± 0.09), subglobose, thick-walled, pale green in KOH, yellow or orange-brown or dextrinoid with dark brown wall in Melzer's. *Basidia* 22.4-34.4 × 9.6-12.8 µm, clavate, 4-sterigmate. *Basidioles* 12.8-25.6 (-36) × 4.8-15.2 µm, clavate. *Cheilocystidia* 18.4-37.6 (-46.4)× 3.2-5.6 µm, cylindric, cylindric-clavate, fusoid. *Pileipellis* an entangled trichodermium of erect hyphae 5.6-17.6 µm diam., elongated, thick-walled and with clamp connections; contents yellowish brown in KOH, orange brown or dextrinoid in Melzer's; end cells cylindrical, some with subacute apex. *Stipitipellis* hyphae 3.2-20 (-23.2) µm diam., subparallel to interwoven, with clamp connections, thick-walled; contents golden yellow in KOH.

Habitat: Solitary under *Quercus* spp.

Known distribution: Belize.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Macal River, Guacamayo Bridge at the oak stand above river, 16°53'16.2"N, 89°2'22.2"W, 594 m asl, 14 October 2002, *BOS 360,* BZ 1709 (CFMR). Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 12 October 2002, *TJB 9713*, BZ 3256 (CORT, CFMR).

Notes: *Gyroporus phaeocyanescens* is distinguished by the yellowish brown tones of the pileus and stipe surfaces, tomentose pileus, straw yellow hymenophore and white context that bruised indigo blue mainly in the stipe. Our collections differ from *G. phaeocyanescens* described by Singer *et al.* (1983) because of a scaly rather than tomentose pileus surface, the hymenophore is white rather than straw color, the basidiospores are smaller (8-9.6 × 4.8-5.6 µm vs. 9.3-14.7 × 5.3-6.7), the cystidia are cylindric rather than fusoid or ampullaceous and the context bruised blue in the pileus but not in the stipe. Our collections are also similar to *Gyroporus umbrinisquamosus* Murrill and *G. cyanescens var. violatinctus* Watling, but *G. umbrinisquamosus* has larger basidiospores (9.5-16 × 4.5-7.5 µm vs. 8-9.6 × 4.8-5.6 µm) and it does not stain blue in any part when bruised; *G. cyanescens var. violatinctus* is similar in microcharacters, but it stains blue in all tissues when bruised, with the pileus context bruising first dark lilaceous and then indigo blue.

Suborder *Suillineae* Besl & Bresinsky
Family *Suillaceae* (Singer) Besl & Bresinsky
Genus Suillus Gray
54. ***Suillus brevipes*** (Peck) Kuntze, Revisio Generum Plantarum 3: 535 (1898). (Figs 109, 115)

Synonyms:
Boletus brevipes Peck, Ann. Rept. N. Y. State Mus. 38: 110 (1885).
Boletus viscosus Frost *non* Venturi, Bull. Buffalo Soc. Nat. Sci. 2: 101 (1874).
Suillus brevipes var. *aestivalis* Singer, Farlowia 2: 217 (1945).
Rostkovites brevipes (Peck) Murrill, Lloydia 11:20 (1948).

Pileus 18-58 mm diam., broadly convex, glutinous, with fine appressed fibrils under gluten, strongly viscid; ground color Chamois (4A4) with Verona Brown (6E7) or Cinnamon (5C4) fibrils, not bruising, reddish brown in KOH, brown in NH_4OH; margin decurved, forming a sterile band; worm hole color Chamois (4A4). *Context* soft, watery, white, yellow above tubes, red or pink in KOH, pale grayish vinaceous in NH_4OH; 6-15 mm thick at center, 2 mm at margin. *Odor* fruity, peach-like. *Taste* sweet. *Tubes* adnate, 2-6 mm long, Straw Yellow (3B4), not bruising, pale grayish vinaceous in KOH, negative in NH_4OH; *pores* radially elongated, compound, 1-1.5 × 0.5-1 mm, Straw Yellow (3B4), not bruising. *Stipe* 19-32 mm long, 5-10 mm wide at apex, 6-10 mm at middle, 5-8 mm at base, subequal, tapered at base, finely felty or finely pruinose, white, not bruising, pale grayish vinaceous in KOH and NH_4OH; worm hole color pale pink to pale grayish vinaceous. *Context* white with some areas pale grayish vinaceous, not bruising, grayish vinaceous in KOH and NH_4OH. *Basal mycelium* white. *Spore print* not obtained.

Basidiospores 6.4-8.8 × 2.4-3.2 µm (n = 20; 7.72 ± 0.83 × 2.95 ± 0.39; Q_m = 2.65 ± 0.33), subfusiform, greenish yellow in KOH, pale yellow, yellowish brown or dextrinoid in Melzer's. *Basidia* 17.6-21.6 × 4.8-5.6 µm, clavate, 4-sterigmate. *Basidioles* 16-21.6 × 4.8-5.6 µm, clavate. *Pleurocystidia* 35.2-58.4 × 4.8-6.4 µm, in clusters, cylindrical, with an amorphous brown pigment surrounding the base of the cluster and with yellowish brown contents in KOH, contents yellowish brown or dextrinoid in Melzer's. *Cheilocystidia* 25.6-45.6 × 4.4-8.8 µm, in clusters, cylindrical, with an amorphous brown pigment surrounding the base of the cluster and with yellow or dark brown contents in KOH. *Pileipellis* an ixotrichodermium of hyphae 3.2-8.8 µm diam., orange brown in Melzer's. *Stipitipellis* hyphae 4-14.4 µm diam., hyaline or with grayish brown contents in KOH, in some areas Vinaceous Pink (8D4) in KOH, giving rise to clusters of *caulocystidia*; these 32-64 × 4.4-5.6-7.2 µm, cylindrical, with an amorphous brown pigment surrounding the base of the cluster and with gray or yellowish brown contents in KOH; contents yellowish brown or orange brown in Melzer's; oil drops orange brown in Melzer's.

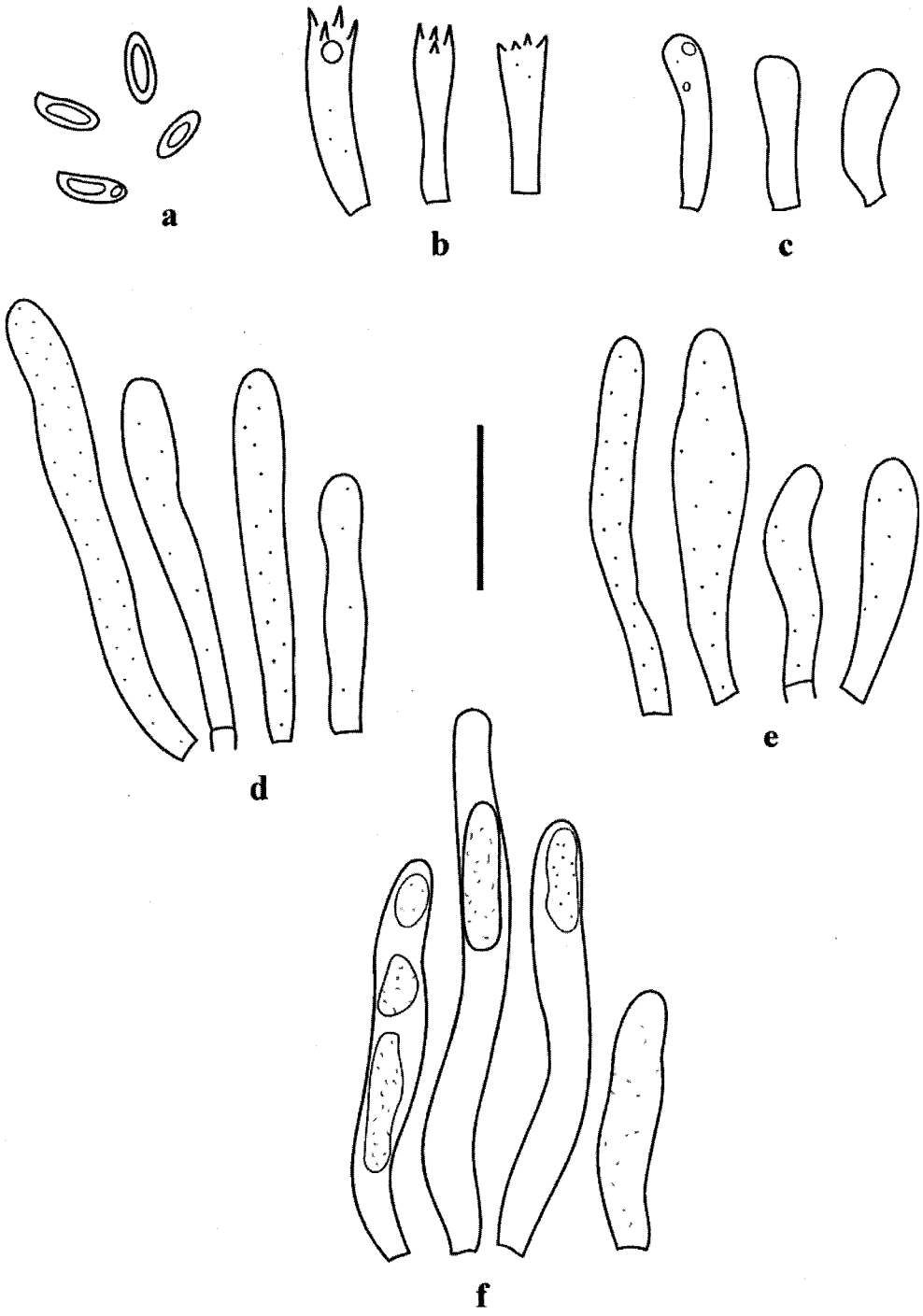


Fig. 109. *Suillus brevipes*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Caulocystidia. *BOS 467*. Scale bar = 20 µm.

Habitat: Gregarious under *Pinus caribaea* and *Quercus* spp.

Known distribution: Widely distributed throughout North America; Belize in Central America (first report for Central America); Cuba in the Caribbean.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Macal River, Guacamayo Bridge at the oak stand above river, 16°53'16.2"N, 89°2'22.2"W, 594 m asl, 26 November 2002, *BOS 467,* BZ 2394 (BRH, CFMR).

Notes: *Suillus brevipes* is distinguished by the glutinous and vinaceous brown pileus that becomes paler with time, and a short white glabrous stipe. This collection agrees with those described by Smith and Thiers (1964), though it has dextrinoid spores and narrower pleurocystidia (4.8-6.4 µm vs. 6-9 µm).

55. ***Suillus decipiens*** (Peck) Kuntze, Rev. Gen. Pl. 3: 535 (1898).

(Figs 110, 116)

Synonyms:

Boletus decipiens Berk. & M.A. Curtis, Ann. Mag. Nat. Hist., 12: 430 (1853).

Boletinus decipiens Peck, Bull. New York State Mus. 8: 78 (1889).

Boletinus berkeleyi Murrill, Mycologia 1 (1): 6 (1909).

Boletinus floridanus Murrill, Lloydia 6: 224 (1943).

Suillus berkeleyi (Murrill) H. Engel & Klofac, Schmier- und Filzröhrlinge s.l. in Europa: 12 (1996).

Pileus 27-115 mm diam., nearly hemispheric to convex or plane, appressed squamose to wooly scaly, slightly viscid when wet; ground color Flesh Ocher (7C5) with Cinnamon (5C4) scales, paler at center, negative in KOH, blue then brownish blue in NH_4OH; margin incurved becoming decurved, appendiculate. *Context* yellow, not bruising, purple or reddish brown in KOH, pale red in NH_4OH; 7-13 mm thick at center, 3-4 mm at margin. *Odor* sweet, fruity. *Taste* not determined. *Tubes* adnate with a short or long decurrent tooth, 1.5-6 mm long, yellow, not bruising, reddish brown to blackish red in KOH, red in NH_4OH; *pores* radially elongated, compound, 1.5-2 × 0.5-1 mm, yellow, not bruising. *Stipe* 32-62 mm long, 5-9 mm wide at apex, 5-12 mm at middle, 7-15 mm at base, solid, equal, clavate or tapered at base, felty; ground color Salmon Color (6B4) or yellow ochre with dark brown or Hazel (8E5) hairs, dark reddish brown in KOH, reddish brown in NH_4OH. *Context* yellow, bruising orange gray, becoming pastel red to Burnt Sienna (8F6-7), dark reddish brown in KOH, pale red in NH_4OH. *Basal mycelium* pale yellow or pale Salmon Color (6B4). *Veil* whitish orange, very thin, fragile, upturned, ephemeral. *Spore print* not obtained.

Basidiospores 7.2-9.6 (-10.4) × 3.2 (-4) µm (n = 20; 8.82 ± 0.9 × 3.24 ± 0.18; Q_m = 2.63 ± 0.03) subfusiform, pale green or yellowish brown in KOH, yellow or orange brown in Melzer's with dark brown walls. *Basidia* 24-25.6 × 5.6-6.4 µm, clavate, 4-sterigmate. *Basidioles* 20.8-24.8 × 4.8-5.6 µm, clavate.

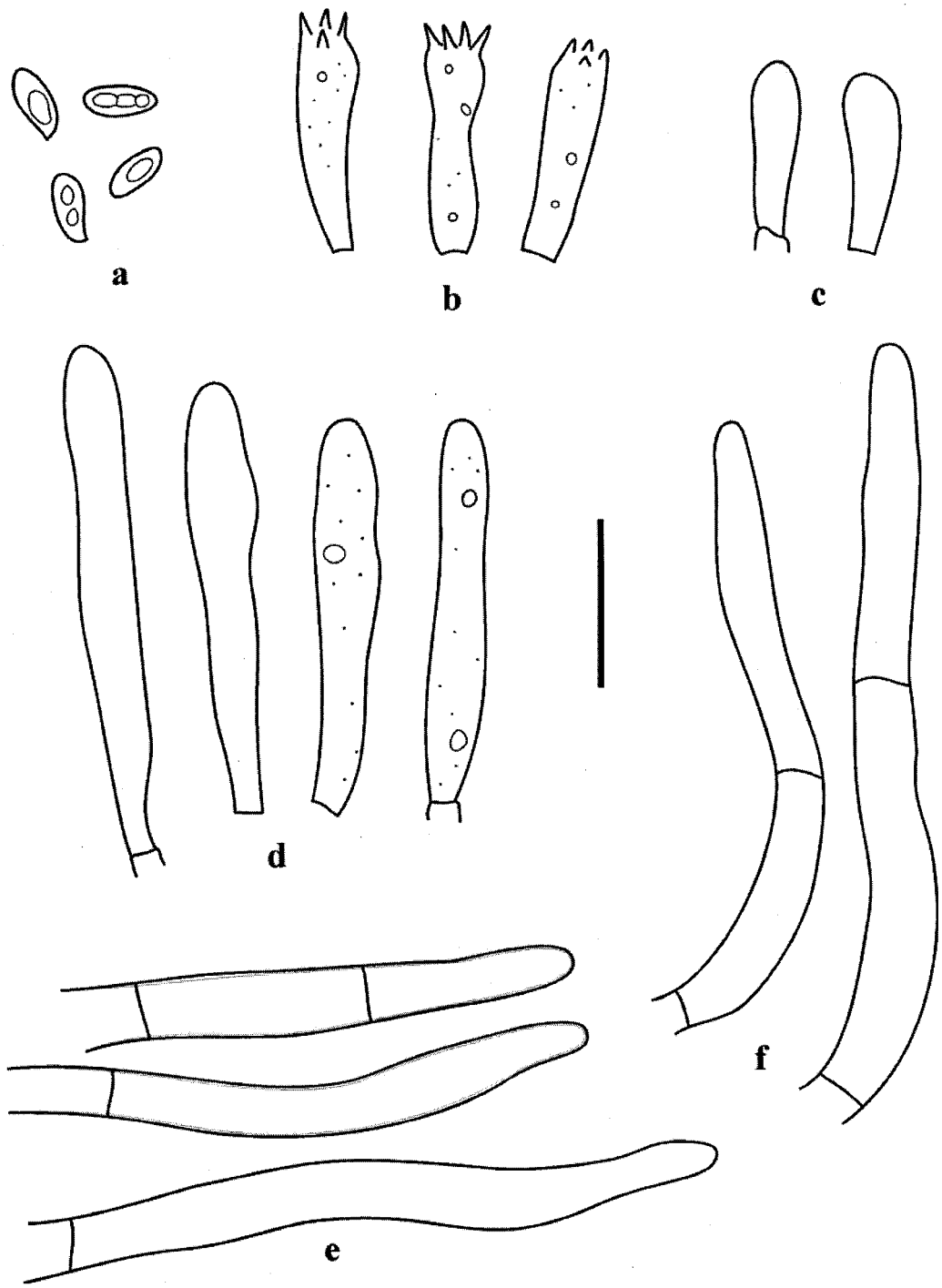


Fig. 110. *Suillus decipiens*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** End-cells of pileipellis; **f.** Elements of the stipitipellis. *BOS 375.* Scale bar = 20 μm.

Hymenial cystidia scattered, solitary or in clusters, 40.8-60 × 5.6-6.4 µm, cylindrical or subfusiform, hyaline or with yellowish brown contents in KOH, contents yellow or yellowish brown in Melzer's. *Pileipellis* a tangled layer of repent hyphae 4-12.8 µm diam., elongated, subgelatinous, incrusted in some areas, thin to moderately thick-walled, contents gray or grayish yellow or pale yellow in KOH, yellow or yellowish brown in Melzer's; end cells cylindrical. *Stipitipellis* hyphae 3.2-13.6 µm diam., long interwoven hyphae, multi-septate, hyaline or grayish yellow in KOH; end cells cylindrical, some with golden yellow contents in KOH.

Habitat: Gregarious or caespitose under *Pinus caribaea*, *P. occidentalis* and *Quercus* spp.

Known distribution: New Jersey to Florida, west to Texas and south to Mexico in North America; Belize and Nicaragua in Central America; Cuba and the Dominican Republic in the Caribbean.

Material examined: BELIZE. Belize District: Belize Zoo area near Democracia, at Foster's property, 17°16'49"N, 88°32'50.2"W, 30 m asl, 18 October 2002, *BOS 375*, BZ 1724 (BRH, CFMR); 14 October 2003, *BOS 619*, BZ 3172 (BRH, CFMR); *TJB 9726*, BZ 3269 (BRH, CORT); 16 October 2003, *REH 8563*, BZ 3344 (BRH, NY); Tropical Education Center, 17°21'27"N, 88°32'30"W, 23 m, 16 October 2002, *BOS 280*, BZ 1625 (BRH, CFMR). Cayo District: Mountain Pine Ridge Reserve, Douglas da Silva, swamp near British Military Camp, 16°58'8.9"N, 88°59'38.4"W, 450 m asl, 19 October 2002, *BOS 379*, BZ 1728 (BRH, CFMR); 23 November 2002, *BOS 456*, BZ 2383 (BRH, CFMR); 3 October 2003, *REH 8513*, BZ 3292 (BRH, NY). DOMINICAN REPUBLIC. Santiago Province: La Celestina, Plan Sierra Community Forest, 19°23'17"N, 71°1'57"W, 550 m asl, 16 November 2003, *TJB 9802*, DR 2874 (JBSD, CORT, CFMR); *BOS 630*, DR 3026 (JBSD, CFMR).

Notes: *Suillus decipiens* is distinguished by the reddish cinnamon scaly pileus surface with orange to yellow hues making up the ground color, the absence of glandular dots on the stipe and the presence of a fibrillose veil. Our collections agree with those described by Smith and Thiers (1964) and Singer (1945b), differing somewhat in the sizes of the hymenial cystidia (40.8-60 × 5.6-6.4 µm vs. 43-72 × 7-9 µm vs. 50 × 13 µm, respectively.

56. ***Suillus pseudoalbivelatus*** B. Ortiz & Lodge, **sp. nov.** (Figs 111, 117)
MycoBank: 511061

Etymology: *pseudo* - false; *albivelatus* - referring to *Suillus albivelatus*.

Pileus glutinous, super discum rugulosus, albido-roseus demum cinnamomeo-flavus, margo appendiculatus. *Contextus* albus, juxto tubos flavus, immutans. *Tubi* adnati, decurrentes, cremei vel pallide flavi, *pori* concolores. *Stipes* ventricosus, sursum glandulosus, deorsum subtiliter tomentosus, albus vel flavido-brunneus, velum partiale membraneus, albus, viscidus.

Pileus 13-67 mm diam., hemispheric to convex or plane, glutinous, smooth, some rugulose at center, ground color whitish pink to Pale Horn Color (4B3) with pale yellow tones, becoming Verona Brown (6E7), Tawny Olive (5C4) or pale Cinnamon Drab (7D4), fading to Buff (4B4) or Sulphur Yellow

(3B5), not bruising, damaged areas becoming yellowish brown to brown; pink to vinaceous in KOH (grayish blue in older specimens), negative in NH_4OH (coral red in older specimens); margin incurved, appendiculate, with white cottony patches from veil remnants. *Context* soft, white, yellow above tubes, not bruising, pink to vinaceous in KOH (grayish blue in older specimens), pale pink to coral in NH_4OH; 4-16 mm thick at center, 1-5 mm at margin; worm holes Sayal Brown (6D5). *Odor* fruity, peach-like. *Taste* mild, fungoid. *Tubes* adnate with long decurrent tooth, 1.5-5 mm long, Cream Color (4A3), pale yellow to Straw Yellow (3B4) to pale Buff (4B4), not bruising, brown in damaged areas, coral red becoming grayish brown in KOH, salmon or coral red in NH_4OH; *pores* nearly circular to angular, pale Cream Color (4A3) becoming Buff (4B4). *Stipe* 18-63 mm long, 6-15 mm wide at apex and middle, 6-11 mm at base, equal to subequal with tapered base, some slightly ventricose, glandular dotted upper half, finely tomentose below; ground color white becoming pale yellow, some with lemon yellow or yellowish brown to dark brown stains; glandular dots white becoming orange brown; negative, grayish vinaceous, greenish blue or yellowish brown in KOH, yellowish brown to greenish brown in NH_4OH. *Context* soft, white to pale yellow, not bruising, the oldest one with Brussels Brown or Walnut Brown (8E5) areas at center and base; negative or pinkish orange to yellowish brown in KOH, greenish blue or pale brown in NH_4OH; worm holes Sayal Brown (6D5) to Verona Brown (6E7). *Basal mycelium* white. Partial veil membranous, white, thin, cottony, viscid, forming a small band in some specimens or leaving remnants at pileus margin as denticulate patches. *Spore print* Tawny Olive (5C4).

Basidiospores 5.6-8.8 × 2.4-4 µm (n = 20; 7.59 ± 0.98 × 3.17 ± 0.29; Q_m = 2.39 ± 0.37), subfusiform, smooth, greenish gray in KOH, yellow or dextrinoid in Melzer's. *Basidia* 14.4-22.4 × 4.8-7.2 µm, clavate, 4-sterigmate. *Basidioles* 12-20.8 × 5.6-6.4 µm, clavate. *Pleurocystidia* 24-68 × 4.8-9.6 µm, cylindrical or cylindric-clavate, hyaline or with yellowish brown contents in KOH, yellowish, yellowish brown or orange brown in Melzer's. *Cheilocystidia* 13-83.2 × 4.8-12 µm, cylindrical or cylindric-clavate, in large clusters, with yellowish brown contents in KOH. *Pileipellis* an ixotrichodermium of hyphae 2.4-9.6 µm diam., encrusted pigments pale orange brown to brown in H_2O, producing few diffusion after the application of KOH; hyaline or with gray or grayish brown contents in KOH, yellow or yellowish brown in Melzer's. *Stipitipellis* hyphae 2.4-16.8 µm diam., parallel or interwoven, hyaline or with pale grayish brown contents in KOH, yellow or yellowish brown in Melzer's. *Caulocystidia* 19.2-80 × 3.2-12.8 µm, in clusters, cylindric-clavate, with an amorphous brown pigment surrounding the base of the cluster; contents grayish brown or brown in KOH, yellowish brown to orange brown in Melzer's.

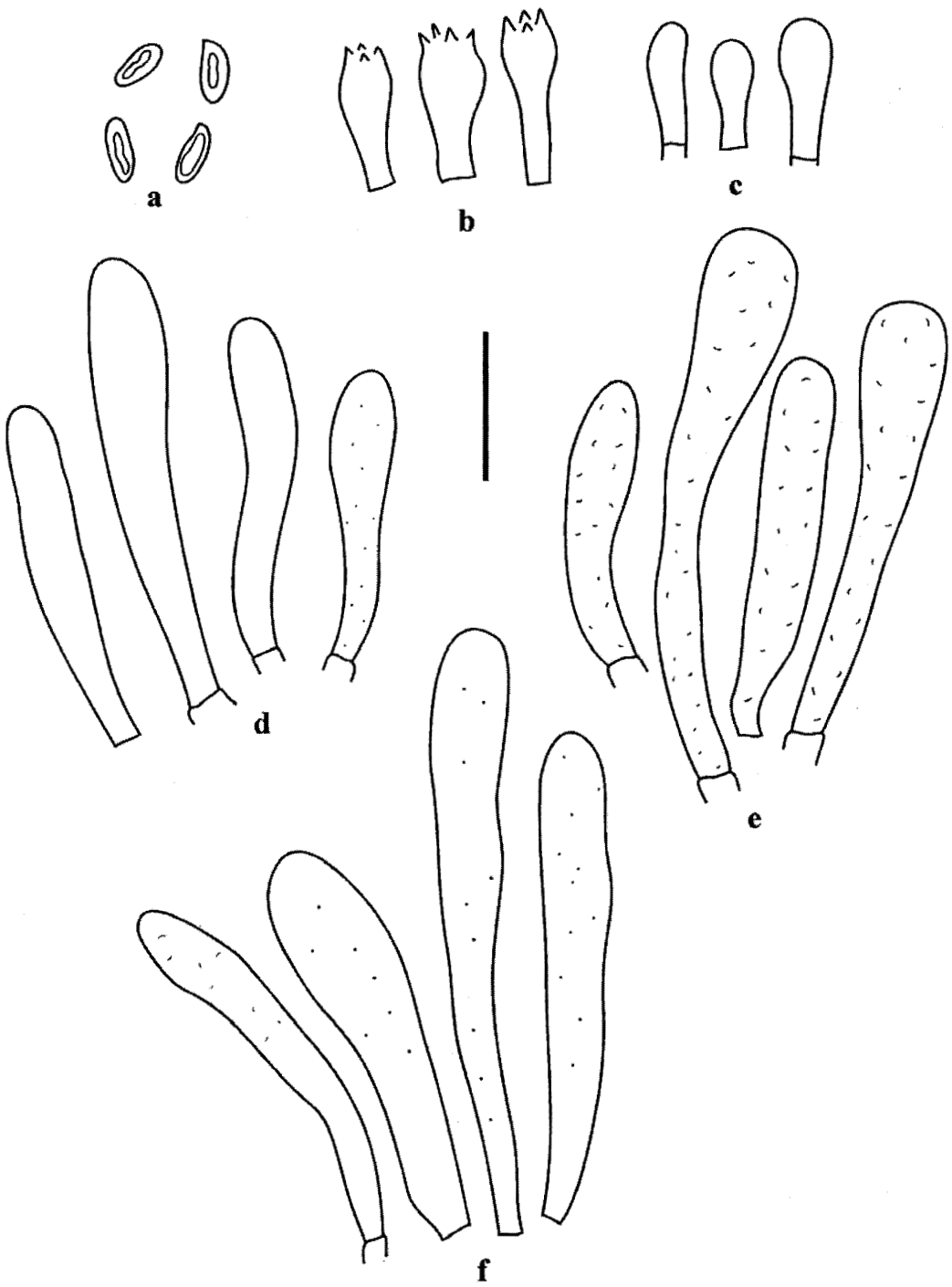


Fig. 111. *Suillus pseudoalbivelatus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** Caulocystidia. *BOS 507*. Scale bar = 20 µm.

Habitat: Gregarious under *Pinus occidentalis*.

Known distribution: Dominican Republic.

Material examined: DOMINICAN REPUBLIC. Santiago Province: Los Montones Arriba, Plan Sierra Conference Center, 19°17'18.4"N, 70°55'31.4"W, 800 m asl, 8 January 2003, *BOS 507*, DR 2531 (CFMR, **holotype**; JBSD, **isotype**); 9 January 2003, *BOS 511*, DR 2335 (JBSD, CFMR); *BOS 512*, DR 2536 (JBSD, CFMR); José Almonte's property at Carrizal, 14 January 2003, *BOS 537*, DR 2561 (JBSD, CFMR). La Vega Province: at the road to Jumanuco from Jarabacoa, 19°7'8"N, 70°34'1"W, 770 m asl, 11 November 2003, *TJB 9777*, DR 2849 (JBSD, CORT, CFMR).

Notes: *Suillus pseudoalbivelatus* is distinguished by the nearly white or whitish pink basidiomes that become dark brown to cinnamon drab or yellow on pileus and yellowish brown on the stipe with time, white context that is unchanging when exposed but becomes yellow above the tubes and brown at the base of the stipe, a cream to buff yellow hymenophore, glandulae on the stipe that are white at first then becoming orange brown, white veil remnants as cottony patches at the pileus margin and a white mycelium. As typical for some of *Suillus* species the context stains pink, vinaceous or coral red with the application of KOH.

This new species belongs in Section *Suillus* in the *Suillus brevipes* complex. It differs from *S. albivelatus* A.H. Sm., Thiers & O.K. Miller in the absence of squamules on the pileus, a more pallid hymenophore (not ochre yellow), the presence of glandular dots on the stipe apex, and the absence of vinaceous red to red pigments with the application of KOH on the hymenium as observed in *S. albivelatus*. The new species differs from *S. brevipes* in having a pallid pileus (not vinaceous brown to yellow), the presence of glandular dots on the stipe apex, and somewhat shorter basidiospores (5.6-8.8 × 2.4-3.2 μm vs. 7-10 x 2.8-3.2 μm). *Suillus pseudoalbivelatus* differs from *S. pseudobrevipes* A.H. Sm. & Thiers in having a pallid pileus and hymenophore, absence of floccules or a ring on the stipe, the glandular dots that become brown and longer hymenial cystidia (24-83.2 × 4.8-12 μm vs. 20-30 x 5-10). Molecular sequences of the rDNA ITS and rDNA LSU genes confirmed this as a new species of *Suillus* (Ortiz-Santana, 2006).

57. ***Suillus salmonicolor*** (Frost) Halling, Mycologia 75 (1): 85 (1983). (Figs 112, 118)

Synonyms:

Boletus salmonicolor Frost, Bull. Buffalo Soc. Nat. Sci. 2: 100 (1874).

Suillus subluteus (Peck) Snell in Slipp & Snell, Lloydia 7: 34 (1944).

Suillus pinorigidus Snell & E.A. Dick, Mycologia 48: 304 (1956).

Pileus 21-72 mm diam., broadly conic, becoming plane with umbo, glutinous, with finely appressed scales under gluten, moderately to strongly viscid when wet, Yellow Ocher (5C4) to Chamois (4A4), not bruising,

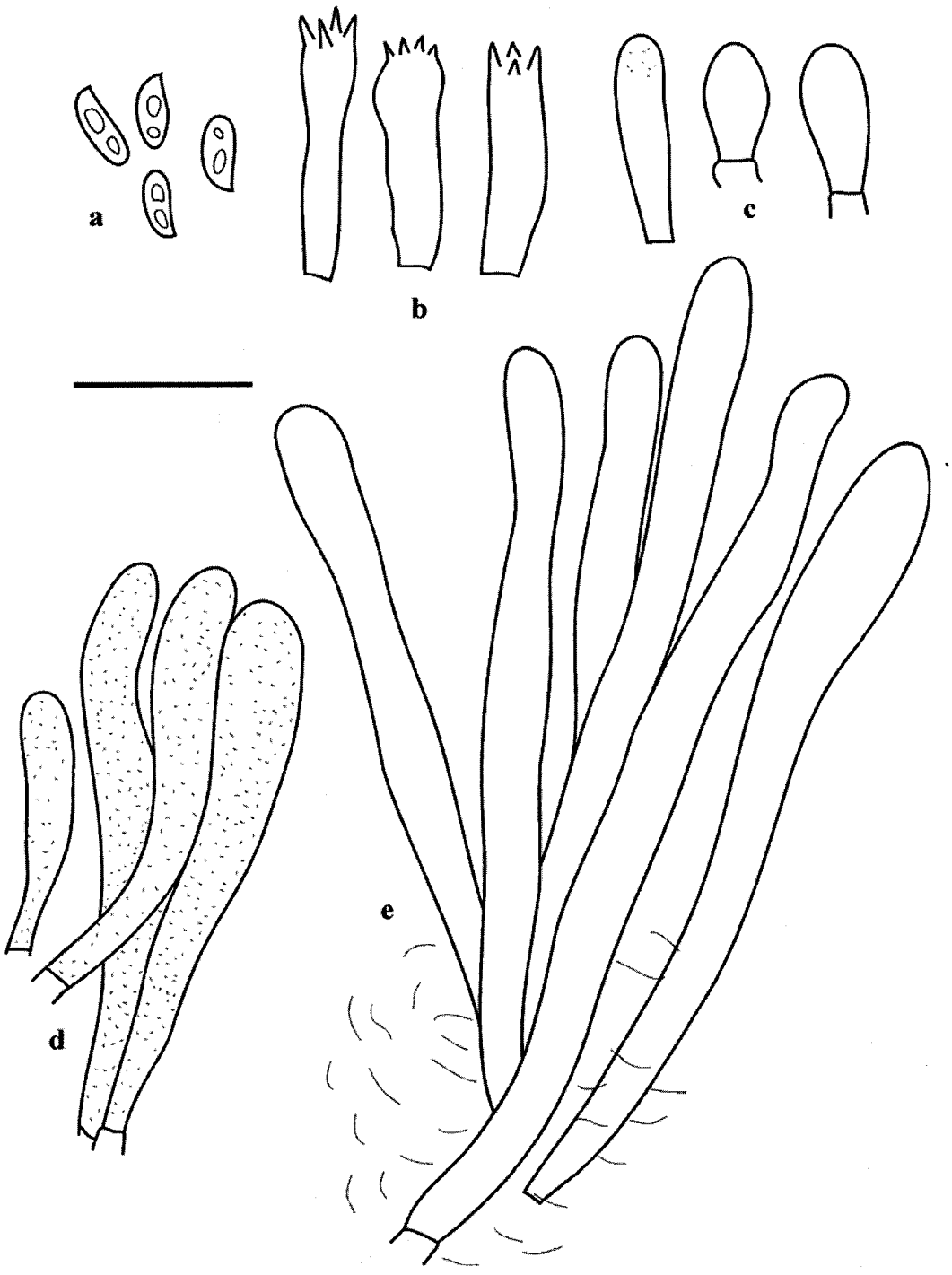


Fig. 112. *Suillus salmonicolor*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Hymenial cystidia; **e.** Caulocystidia. *BOS 378*. Scale bar = 20 µm.

Vinaceous (11B5) in KOH, reddish brown in NH_4OH, grayish black in $FeSO_4$; margin incurved, decurved or recurved, undulating, appendiculate. *Context* viscid, soft, pale Salmon Color (6B4), darkening when bruised, Deep Vinaceous (11C5) to blackish purple in KOH, reddish brown in NH_4OH, grayish black in $FeSO_4$; 6-13 mm thick at center, 2-3 mm at margin. *Odor* fruity, peach-like. *Taste* sweet. *Tubes* adnate with a tooth or slightly decurrent, 2.5-8 mm long, Yellow Ocher (5C4), not bruising, blackish purple in KOH, reddish brown to dark brown in NH_4OH; *pores* radially elongated, 1-1.5 × 0.5-1 mm, pale brown with Flesh Ocher (7C5) dots, not bruising. *Stipe* (20-) 22-57 mm long, 4-9 mm wide at apex, 4-8 mm at middle, 4-8 mm at base, equal or slightly tapered at base, glandular dotted, tomentose at base, yellow at apex, pale Salmon Color (6B4) below, becoming gray; glandular dots Robin Rufous (7E8) to blackish brown; negative or Vinaceous (11B5) in KOH, negative in NH_4OH, orange brown in $FeSO_4$. *Context* fibrous, slightly viscid, Chamois (4A4) to Salmon Color (6B4), not bruising, pale Vinaceous (11B5) in KOH, negative in NH_4OH, brown in $FeSO_4$. *Basal mycelium* pale Salmon Color (6B4). *Veil* glutinous, viscid, white, and cottony. *Annulus* upturned, attached, viscid, whitish gray. *Spore print* Sayal Brown to Verona Brown.

Basidiospores 6.4-9.6 (-11.2) × 3.2-4 µm (n = 20; 8.54 ± 0.88 × 3.26 ± 0.21; Q_m = 2.51 ± 0.34), fusiform, greenish yellow in KOH, dextrinoid in Melzer's. *Basidia* 18.4-26.4 × 5.6-6.4 µm, cylindric-clavate, 4-sterigmate. *Basidioles* 11.2-23.2 × 4-6.8 µm, clavate, cylindrical. *Pleurocystidia* absent. *Cheilocystidia* 21.6-68 × 4.8-8.8 (-11.2) µm, in clusters, cylindrical, hyaline or with dark brown contents in KOH. *Pileipellis* an ixotrichodermium of hyphae 2.4-12.8 (-13.6) µm diam., hyaline in KOH; end cells cylindrical. *Stipitipellis* hyphae 3.2-10.4 (-16.8) µm diam., parallel, subgelatinous in some areas, hyaline in KOH; dots consisting of clusters of caulocystidia of 36.8-84 × 5.6-9.6 µm diam., with an amorphous brown pigment surrounding the base of the cluster; hyaline or with orange brown contents in KOH (mainly at base), dextrinoid in Melzer's. *Annulus* hyphae 3.2-9.6 µm diam., interwoven, some parallel; hyaline in KOH.

Habitat: Gregarious under *Pinus caribaea* and *P. occidentalis*.

Known distribution: Eastern Canada south to Florida in North America; Belize in Central America (first report for Central America); the Dominican Republic in the Caribbean.

Material examined: BELIZE. Cayo District: Mountain Pine Ridge Forest Reserve, Douglas da Silva, swamp near British Military Camp, 16°58'8.9"N, 88°59'38.4"W, 476 m asl, 19 October 2002, *BOS 378,* BZ 1727 (BRH, CFMR); Forestry Station camp ground, 6°58'22.9"N, 88°59'44"W, 456 m asl, 4 October 2002, *BOS 323*, BZ 1672 (BRH, CFMR); Blancaneaux Lodge, road to Five Sisters, in front of Blancaneaux Lodge, 17°2'20.4"N, 88°57'15.5"W, 475 m asl, 29 November 2002, *BOS 475*, BZ 2403 (BRH, CFMR).

DOMINICAN REPUBLIC. Santiago Province: Rincón de Piedra, 19°12'25.6"N, 70°55'11"W, 850 m asl, 12 January 2003, *BOS 527*, DR 2551 (JBSD, CFMR); Carrizal, José Almonte's property, 19°14'56.2"N, 70°56'53.1"W, 765 m asl, 14 January 2003, *BOS 538*, DR 2562 (JBSD, CFMR).

Notes: *Suillus salmonicolor* is distinguished by the glutinous pileus and the glutinous hanging veil, the dark salmon colors over the basidiocarp and the reddish brown to dark brown glandulae on the stipe. Our collections agree with those described by Halling (1989), although it has narrower hymenial cystidia (2.4-8.8 vs. 10-13 µm) and longer caulocystidia (36.8-84 vs. 45 µm).

58. ***Suillus tomentosus*** (Kauffman) Singer, Mycologia 51: 570 (1960). (Figs 113, 119)

Synonyms:
Boletus tomentosus Kauffman, Papers Mich. Acad. Sci. Arts & Letters 1: 117 (1921).
Boletus hirtellus var. *mutans* Peck, nom. nud.
Suillus hirtellus var. *mutans* (Peck) Snell, Lloydia 7: 23 (1944).
Xerocomus lenticolor E.A. Dick & Snell, Mycologia 52: 448 (1960).

Pileus 9-72 mm diam., hemispheric, convex-umbonate to convex, tomentose to appressed squamulose, ground color orange (6A6) to pale Chamois (4A4), the oldest one with Clay Color (5D5) to Cinnamon (5C4) scales, bruising slowly blue, reddish brown in KOH, blue then Cinnamon (5C4) in NH_4OH; margin inrolled to decurved forming a small band. *Context* soft, pale Cream Color (4A3) or pale Chamois (4A4), to pale yellow, bruising blue, reddish brown in KOH, blue then Cinnamon (5C4) in NH_4OH; 5-20 mm thick at center, 1.5-3 mm at margin. *Odor* fruity, peachy. *Taste* mild, sweet. *Tubes* adnate or adnate with a decurrent tooth, 1-6 mm long, Chamois (4A4) to Olive Yellow (2C5), bruising slowly blue, reddish brown in KOH, blue then yellowish brown in NH_4OH; *pores* irregular, 1-2/mm, pale yellow or Chamois (4A4) with translucent or Tawny (6-7D7) dots, becoming reddish brown because of the dots. *Stipe* 19-85 mm long, 5-15 mm wide at apex, 7-14 mm at middle, 9-13 mm at base, clavate to subequal, glandular dotted overall; ground color pale Chamois (4A4) or Cream Color (4A3) becoming yellow; dots Clay Color (5D5) to Tawny (6-7D7) then Raw Umber (5E5-6); bruising Sayal Brown (6D5), orange yellow in KOH, Tawny Olive in NH_4OH. *Context* soft to fibrous, Cream Color (4A3) or pale Chamois (4A4), bruising blue, orange yellow in KOH, Tawny Olive in NH_4OH. *Basal mycelium* pale pink to vinaceous. *Spore print* not obtained.

Basidiospores 8-10.4 × 3.2 µm ($n = 20$; $9 \pm 0.73 \times 3.2$; $Q_m = 2.81 \pm 0.23$), fusiform, pale green in KOH, brown to dextrinoid in Melzer's. *Basidia* 16-22.4 × 5.6 µm, cylindric-clavate, 4-sterigmate. *Basidioles* 13.6-16.8 × 5.6-7.2 µm, clavate. *Pleurocystidia* 38-61 × 6.4-8 µm, cylindrical, few, hyaline in KOH. *Cheilocystidia* 28-74.4 × 7.2-11.2 µm, numerous, in clusters, cylindrical,

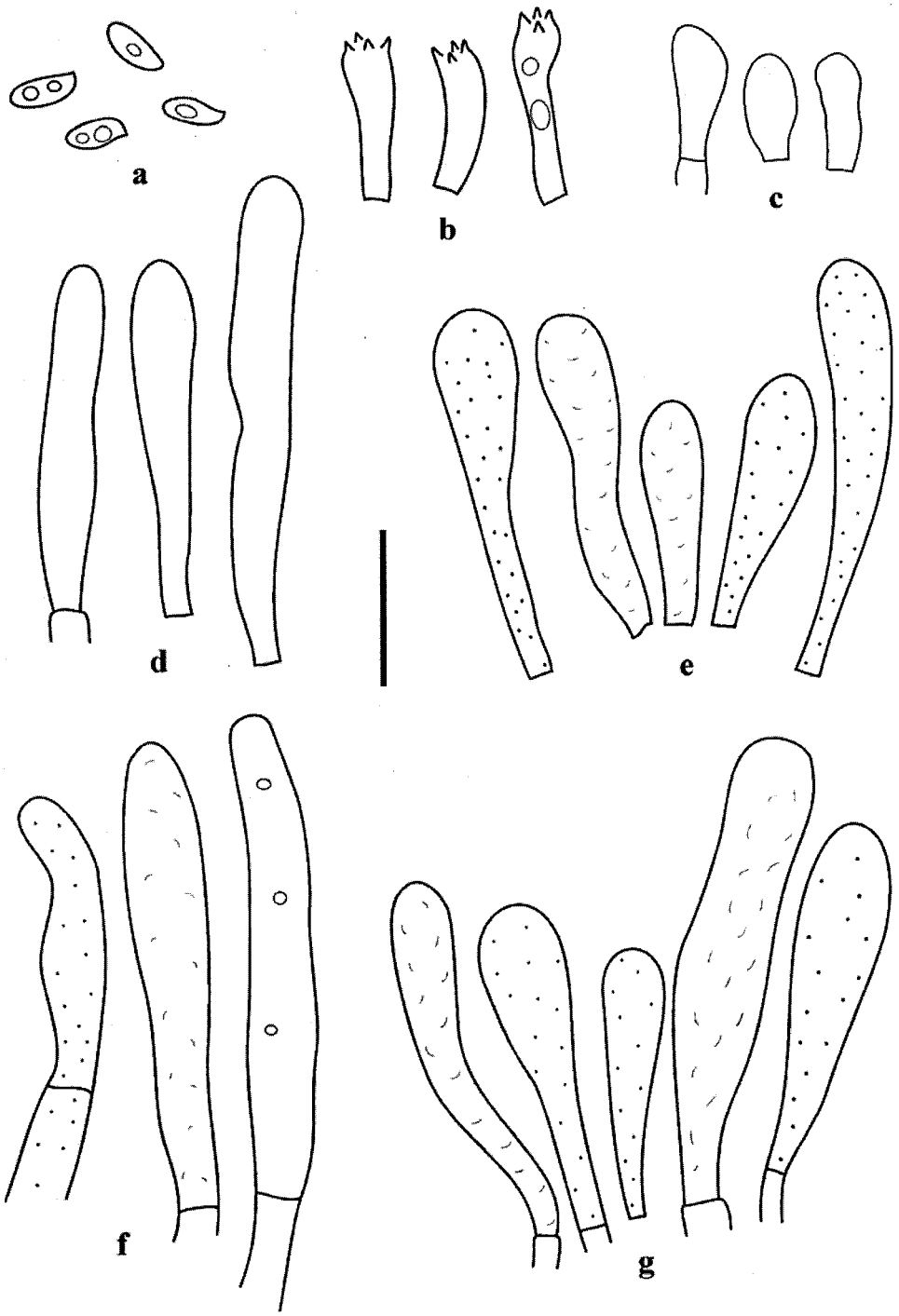


Fig. 113. *Suillus tomentosus*. **a.** Basidiospores; **b.** Basidia; **c.** Basidioles; **d.** Pleurocystidia; **e.** Cheilocystidia; **f.** End-cells of pileipellis; **g.** Caulocystidia. *BOS 536.* Scale bar = 20 µm.

cylindric-clavate, with yellowish brown or dark brown contents in KOH. *Pileipellis* an ixotrichodermium of hyphae 4-16 µm diam., elongated, encrusted pigments and contents brown or orange brown in KOH. *Stipitipellis* hyphae 3.216.8 µm diam., elongated, interwoven, subgelatinous. *Caulocystidia* 33.6-75.2 × 7.2-12 µm, broadly clavate, cylindric, cylindric-clavate, some collapsed; encrusted pigments and contents yellowish brown to orange brown in KOH.

Habitat: Gregarious under *Pinus occidentalis*.

Known distribution: Eastern Canada to the Carolinas, the Pacific Northwest to California and south to Mexico in North America; the Dominican Republic in the Caribbean (first report below North America).

Material examined: DOMINICAN REPUBLIC. Santiago Province: Carrizal, José Almonte's property, 19°14'56.2"N, 70°56'53.1"W, 765 m asl, 14 January 2002, *BOS 536* , DR 2560 (JBSD, CFMR); Las Placetas, 19°13'27"N, 70°53'27"W, 1100 m asl, 8 January 2003, *BOS 506*, DR 2530 (JBSD, CFMR).

Notes: *Suillus tomentosus* is characterized by the fibrillose scaly pileus with yellow to orange-yellow ground color and gray, yellow or reddish brown scales, a context that stains slowly and irregularly blue after bruising, yellow tubes with brown to vinaceous brown pores and a yellow to dull orange yellow stipe with orange brown glandular dots. Our collection differs from those cited by Smith and Thiers (1971) in having scales colored more cinnamon than gray, pores that start out yellow then become reddish brown, smaller basidia (16-22.4 × 5.6 µm vs. 26-34 × 5-8 µm) and longer hymenial cystidia (28-61 (-74) × 6.4-11.2 µm vs. 30-46 × 7-10 µm).

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