

## Two new *Aroramyces* species (*Hysterangiaceae*, *Hysterangiales*) from México

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**Abstract:** Little is known of the truffle-like fungi of northern Mexico. Few mycologists have collected truffle-like specimens in this area. The wide diversity of habitat and potential mycorrhizal partners portend a unique and varied truffle-like mycota. In the conduct of recent field studies in this region we collected many interesting truffle-like specimens. We present two taxa that have unique characteristics, brownish spores with spines embedded within a distinctly inflated utricle surrounding each spore. *Aroramyces balanosporus* and *A. herrerae* are described as new species. This is the first record of the genus *Aroramyces* from North America.

**Key words:**

Basidiomycetes  
truffle  
truffle-like  
sequestrate fungi  
hypogeous fungi  
taxonomy

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### INTRODUCTION

The generic name *Aroramyces* Castellano & Verbeken 2000 (syn. *Radiogaster* McGinty 1924; nom. inval.) was introduced for two species described from tropical and subtropical habitats in Africa and Australia: *A. gelatinosporus* (J.W. Cribb) Castellano 2000 and *A. radiatus* (Lloyd) Castellano *et al.* 2000. Five additional species from Australia remain undescribed (Francis & Bougher 2003). *Aroramyces* was segregated from *Hysterangium* by Castellano *et al.* (2000) mainly on the basis of spore characters (prominent spines on the spore surface within an inflated utricle) and a pink to brown, gelatinized gleba, while *Hysterangium* is characterized by a green-toned gleba with smooth, hyaline spores (Castellano *et al.* 2000, Montecchi & Sarasini 2000). Recent phylogenetic studies placed both *Hysterangium* and *Aroramyces* in the family *Hysterangiaceae* (*Hysterangiales*) and postulate that all members of this family are obligate ectomycorrhizal fungi with angiosperms and gymnosperms (Hosaka *et al.* 2008). The genus *Aroramyces* had not been reported from North America until recent field trips to forests in central México from 2007 to 2011 yielded two undescribed *Aroramyces* species.

### MATERIAL AND METHODS

Methods of collection, macroscopic, and microscopic study were generally those of Castellano *et al.* (1989) and Pegler *et al.* (1993). Colours of fresh basidiomes are given in general terms of the collectors. Dried specimens were hand cut and mounted in 5 % KOH, Melzer's reagent, or water for

microscopic observation. Fungal specimens are deposited in ITCV and OSC. Spore measurements were made with a compound microscope at 1000x under oil immersion on 20 spores.

### TAXONOMY

***Aroramyces balanosporus* Guevara & Castellano, sp. nov.**  
Mycobank MB812927  
(Fig. 1 A–F)

**Etymology:** “*balanosporus*” in reference to the shape of the spores that resemble an oak acorn formed by the irregular inflation of the utricle.

**Diagnosis:** This species differs from the two central Africa and northern Queensland species in the brownish spores with a distinct inflated utricle with embedded spines, and also spore size.

**Type: México:** State of Jalisco: road to the volcano Tequila, 20° 49.9'N 103° 51.071'W, hypogeous, 28 Sept. 2009, J Trappe & M Castellano 33802 (ITCV [José Castillo Tovar herbarium] – holotype; OSC – isotype).

**Description: Macrocharacters.** *Basidiomes* globose, sub-globose to irregular, 7–12 x 8–12 x 6–8 mm, peridial surface fibrillose or tomentose, often with cottony-like patches of bright white hyphae which encompass some soil debris and ectomycorrhizal roots scattered across the peridial surface,

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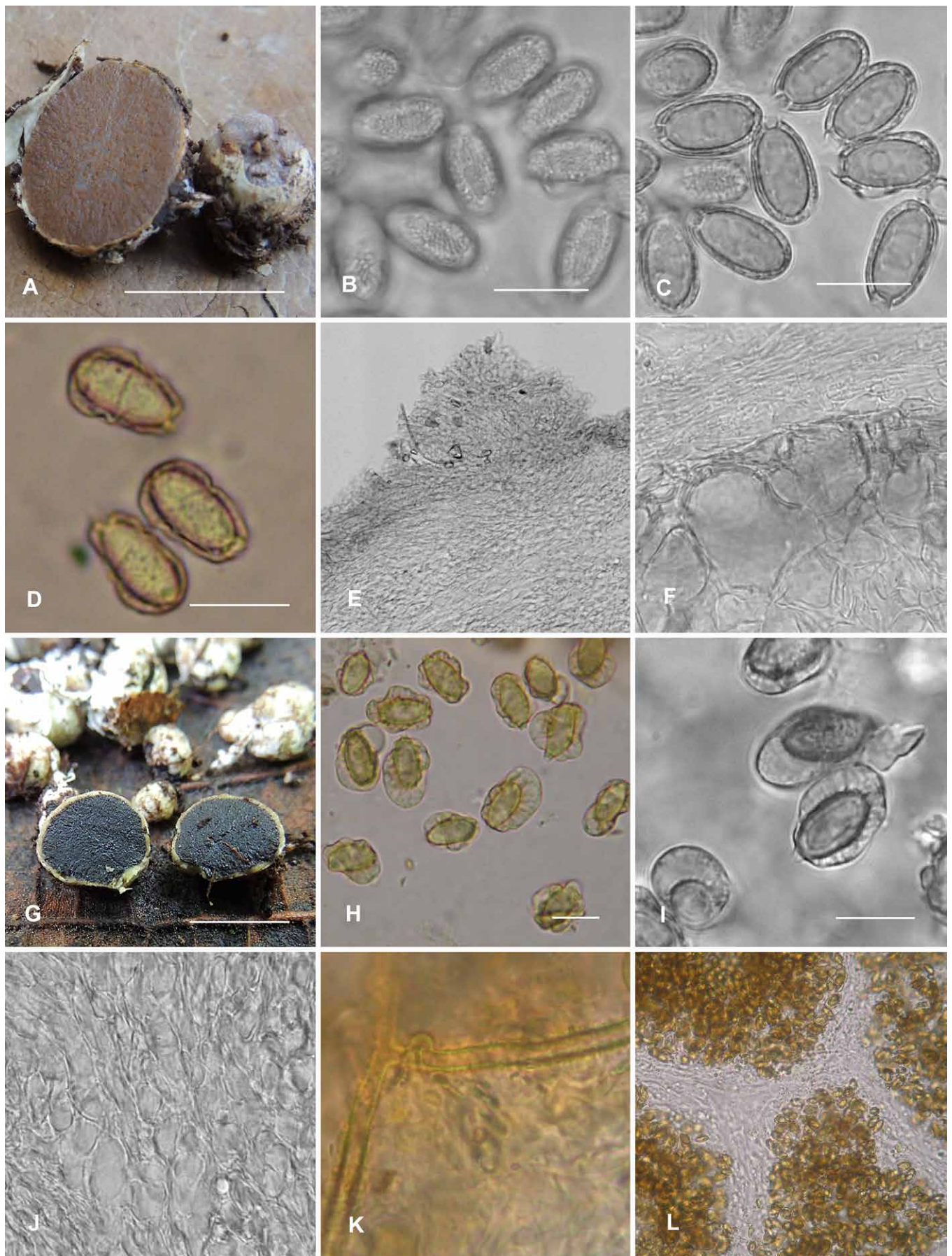
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**Fig. 1.** **A–F.** *Aroramycetes balanosporus* (EBUM 863). **A.** Basidiomes, **B–D.** Basidiospores with spines and equatorial lines. **E.** Caespitose groups of erect, branched, setal hyphae. **F.** Subcutis and mesocutis of pseudoparenchymatous cells. **G–L.** *Aroramycetes herrerae* (ITCV 1211). **G.** Cross-section of basidiome, **H–I.** Basidiospores with inflated utricule. **J.** Inner peridium cells, occasionally with inflated hyphae. **K.** Clamp connections on encrusted hyphae adherent on the outer peridium. **L.** Tramal plate. Bars: A and G = 1 cm; B–D, H–I = 10  $\mu$ m; E–F and J–L not to scale.

to mentum white with pale tan areas, numerous soil particles adhering to surface; odour fungoid or indistinct; taste not recorded. *Peridium* separable and fragile, <0.5 mm thick, white to pale tan in cross-section. *Gleba* brown, gelatinized tramal veins, hard when dried, locules somewhat irregular or elongated. *Columella*, distinct but thin and gelatinized.

**Microcharacters.** *Peridium* 3-layered, 200–450 µm thick. *Epicutis* 38–150 µm thick, of hyaline to reddish brown, thin-walled, interwoven to repent or erect hyphae, 2.5–6 µm broad, forming scattered caespitose groups of erect, branched, setal hyphae 2.5–5 µm broad, with abundant crystalline structures adherent on hyphal walls, clamp connections present. *Mesocutis* 125–180 µm thick, of reddish brown, isodiametric, angular, or irregular hyphae, occasionally interwoven, hyphae 2.5–42 µm broad, walls to 2.5 µm broad. *Subcutis* 40–125 µm thick, of hyaline, repent or interwoven hyphae, ± 3 µm broad. *Hyphae*: occasionally with wide terminal prostrate hyphae to 48 µm broad, broadly clavate, walls to 2.5 µm broad, clamp connections present. *Trama* of hyaline, interwoven to occasionally parallel hyphae, 2–8 µm broad, immersed in a gelatinized matrix, clamp connections present. *Basidia* clavate to broadly clavate, 11–50 x 5–20 µm, hyaline to pale brown, walls to 1 µm broad, 4-spored. *Sterigmata* 4–10 µm long x 2–3 µm broad, hyaline. *Basidiospores* ellipsoid to occasionally broadly-ellipsoid, symmetrical, without utricle and hilar appendage (10–)10.5–11(–11.5) x 5.5–6 µm,  $x = 10.7 \times 5.7$  µm, Q range = 1.71–2.17, Q mean = 1.89; with utricle and hilar appendage 12.5–13.5(–15) x (7 –)7.5–8 µm, mean = 13.3 x 7.6 µm, Q range = 1.67–1.88, Q mean = 1.75, numerous fine spines within the utricle, in KOH hyaline to pale brown singly, reddish brown to dark brown in mass, hilar appendage ± 1 µm long x 2.5 µm broad, walls to 1 µm broad, utricle inflated and to 3 µm broad, hyaline, many spores with inflated utricle toward the distal part of the spore, inamyloid, nondextrinoid.

**Distribution and ecology:** México (states of Jalisco and Michoacán). Hypogeous, under *Carpinus* sp., *Quercus magnifolia*, and *Styrax* sp. at approximately 1730 m elevation, September and November.

**Additional material examined:** México: State of Michoacán: in front of Ooapas water-pump, road to Tumbisca-Ichaqueo, municipality of Morelia, 29 Nov. 2013, V. Gómez-Reyes 848 (EBUM).

**Discussion:** *Aroramyces balanosporus* is recognized by its brownish spores with a distinct, inflated utricle with embedded spines. Two other *Aroramyces* species occur in tropical central Africa or northern Queensland, Australia. *Aroramyces radiatus* from Africa has smaller spores, 10–12(–13.5) x 6–7(–8) µm (with hilar appendage), and associates with *Brachystegia spiciformis* (Caesalpinioideae) or *Uapaca* sp. (Euphorbiaceae). *Aroramyces gelatinosporus* from Australia has similar-sized spores but possesses a single-layered peridium and associates with *Eucalyptus* spp. (Myrtaceae).

**Aroramyces herrerae** Guevara, Gómez & Castellano, sp. nov.  
Mycobank MB812928  
(Fig.1 G-L)

**Etymology:** “*herrerae*” - in honor to Teófilo Herrera Suárez, one of the pioneer mycologists of México.

**Diagnosis:** Differs from all other known *Aroramyces* species in the distinctly inflated wing-like appearance of the utricle (inflated to 6 µm).

**Type:** México: State of Michoacán: Puerto Madroño, 20 km south of Morelia city, ejido Atécuaro, Municipality of Morelia, hypogeous, 18 Oct. 2011, G. Guevara 1211 (ITCV – holotype; OSC – isotype).

**Description:** **Macrocharacters.** *Basidiomes* irregular, globose or subglobose, 5–18 x 6–15 x 5–10 mm, peridial surface white, pale tan to brownish, mottled dark brown with pale areas when handled and when dried, smooth when fresh, much wrinkled when dried, with some white mycelial strands, soil and organic matter adherent to surface, KOH (5%) brown to blackish on the surface of dried specimens; odour acetone/ether solvent-like; taste not recorded. *Peridium* <0.5 mm thick, somewhat separable. *Gleba* brown to dark brown in all stages, nearly black when dried, locules ellipsoid to elongate, stuffed with spores, columella dendroid, gelatinized, grayish. *Rhizomorphs* few, small, white attached at base.

**Microcharacters.** *Peridium* 70–400 µm thick, two-layered. *Epicutis* 45–175 µm thick, usually on the thinner side with occasional areas with wart-like protrusions, of septate, thin-walled, pale yellow-brown to yellow-brown, repent hyphae, 4.5–6.5 µm broad, occasional cells inflated to 18 µm broad, with interspersed small crystalline particles scattered across layer. *Subcutis* 110–135 µm thick, of septate, thin-walled, hyaline, interwoven to subparallel or cross-weaved hyphae, 6.5–11(–15) µm broad. *Mycelial strands* on peridium of dark brown, filiform, branched hyphae, 2–3 µm broad, encrusted with small crystalline particles, clamp connection present. *Trama* 37–112 µm thick, of hyaline, thin-walled, compactly interwoven to parallel hyphae, 2–5 µm broad, in a gelatinized matrix, clamp connections present. *Basidia* not found. *Basidiospores* fusoid, symmetrical, without utricle and hilar appendage 10.5–12.5 x 5.5–7 µm, mean = 11.3 x 6.0 µm, Q range = (1.63–)1.72–2.00(–2.17), Q mean = 1.91, with utricle and hilar appendage (12.5–)13–14 x 8–9.5 (–10.5) µm, mean = 13.5 x 9.0 µm, Q range = (1.25–)1.46–1.60(–1.78), Q mean = 1.51, walls to 1 µm thick, smooth when immature, numerous fine spines within the utricle when mature, utricle distinct, not encompassing hilar appendage to give spore a truncate appearance, utricle often not evenly inflated to protrude from one side or another, occasionally encompassing entire spore originating from the spore base, utricle laterally inflated to 5(–6) µm broad, in KOH hyaline to yellow-orange singly, pale brown in mass, inamyloid, nondextrinoid.

**Distribution and ecology:** México, Michoacán, in the Trans-Mexican Volcanic belt. Hypogeous, solitary, under *Quercus castanea*, *Q. obtusata*, *Q. magnifolia*, *Q. rugosa*, *Pinus leiophylla*, *Pinus pseudostrobus*, and *Pinus michoacana* at approximately 2160 m elevation, September and October.

**Additional material examined:** México: State of Michoacán: Puerto Madroño, 20 km south of Morelia city, ejido Atécuaro, Municipality of

Morelia, 19° 32' 113" N 101° 12' 5"W, 18 Oct. 2011, *G Guevara 1218* (ITCV, OSC); Ichaqueo, Municipality of Morelia, 20 Sept. 2014, *V Gomez-Reyes 863, 877* (EBUM).

*Discussion:* *Aroramyces herrerae* is recognised by its brown gleba and the distinctly inflated, wing-like appearance to the utricle (inflated up to 6 µm).

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