

*Carolinigaster bonitoi*



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***Carolinigaster* M.E. Sm. & S. Cruz, gen. nov.**

*Etymology.* The genus name *Carolinigaster* refers to North Carolina, the region where this truffle was collected, and 'gaster' (Greek for 'stomach') in reference to the fact that the spores of this truffle species are enclosed inside of the fruiting body.

Classification — *Boletaceae*, *Boletales*, *Agaricomycetes*.

Distinguished from other *Boletaceae* by a combination of the following characters: *Basidiomata* hypogeous to partially emergent,

sequesterate, globose to subglobose. *Peridium* not changing colour when handled. *Gleba* loculate. Lacking a stipe or columella. *Basidiospores* statismosporic, globose to subglobose, ornamented with short irregular warts at maturity, pink in water and inamyloid but strongly dextrinoid, bleaching to almost hyaline in KOH. *Clamp connections* and *hymenial cystidia* absent.

*Type species.* *Carolinigaster bonitoi* M.E. Sm. & S. Cruz.  
Mycobank MB827451.

***Carolinigaster bonitoi* M.E. Sm. & S. Cruz, sp. nov.**

*Etymology.* The epithet *bonitoi* is given in reference to mycologist Gregory Bonito – a truffle expert, North Carolina native, and co-collector of the type specimen.

*Basidiomata* hypogeous, globose to subglobose, 0.5–2 cm diam, attached to the substrate by fine white rhizomorphs. *Peridium* bright white to pinkish white, completely enclosing the gleba when young but thinning and wearing away with age, not changing colour when handled or bruised. *Gleba* loculate, locules up to 0.5 mm diam but mostly 0.25 mm or smaller, light pink when young but becoming pinkish brown to light brown in mature specimens, rubbery when fresh. Lacking a columella or sterile base. *Odour* indistinct, *taste* not recorded. *Peridium* 50–210 µm thick, hyaline, comprised of loosely interwoven gelatinised hyphae mostly 5 µm diam, notably softer in 3 % KOH than in water or Melzer's, with occasional incorporated rhizomorphs up to 10 µm diam and slightly dextrinoid. *Basidia* 40–55 × 10–15 µm but narrowing to 5 µm at the base, four-spored, clavate to subcapitate and scattered. Sterigmata mostly 5–6.5 µm long and 0.5–1 µm diam. *Trama* tissues appearing gelatinised, especially when mounted in KOH. *Basidioles* numerous, hyaline, clavate or occasionally subcapitate, 30–45 × 8–13 µm wide, narrowing to 3.5–4.5 µm at the base. *Clamp connections* not observed. *Cystidia* not observed. *Basidiospores* statismosporic, 8.8–11 × 5.9–8.4 µm (av. 9.7 × 7.3 µm), Q = 1.2–1.8 (mean Q = 1.35), globose to subglobose, pink in water, inamyloid and strongly dextrinoid in Melzer's reagent, bleaching to almost hyaline in KOH, spore wall mostly 1 µm, ornamented with triangular to rounded warts that are 0.5–1.5 µm tall × 1–2 µm wide at the base, with a hyaline perispore that is always visible in young spores but is more difficult to see in mature spores, often with a visible hilar appendage that is approximately 0.5 µm diam and 1–2 µm long.

*Habitat & Distribution* — Fruiting in the soil beneath the leaf litter in mixed forests dominated primarily by *Quercus*, *Fagus* and *Pinus* on silty-clay soil. Known only from Durham County but likely present at appropriate sites across North Carolina's Piedmont region.

*Typus.* USA, North Carolina, Durham County, Durham, Duke University Campus, c. 150 m a.s.l., in mixed pine and hardwood forest, hypogeous in

*Colour illustrations.* Mixed *Fagaceae*-dominated forest near in Durham, North Carolina where *Carolinigaster bonitoi* was collected; section of hyaline trama viewed in Melzer's reagent (scale bar = 25 µm), basidiospores showing strong dextrinoid responses when viewed in Melzer's reagent (scale bar = 10 µm), fresh basidiomata (scale bar = 1 cm). All photos are of the holotype MES331 (FLAS-F-62017).

soil below the leaf litter, 21 Oct. 2009, G. Bonito & J. Trappe MES331 (holotype FLAS-F-62017, ITS, LSU and *tef1* sequences GenBank MH747178, MH747179 and MH753704, MycoBank MB827455).

*Additional specimen examined.* USA, North Carolina, Durham County, Durham, Eno River State Park, c. 200 m a.s.l., in mixed pine and hardwood forest, hypogeous in soil below the leaf litter, 16 Oct. 2009, M.E. Smith, MES330, FLAS-F-62018.

*Notes* — *Carolinigaster bonitoi* is unique in having a hypogeous sequesterate fruiting habit, a bright white peridium that does not stain when handled or bruised, and a loculate gleba without a columella or sterile base that is light pink when young but becomes pinkish brown to brown at maturity. It has lightly ornamented spores covered by a perispore. The spores are pinkish in water and strongly dextrinoid in Melzer's reagent but bleach almost completely hyaline in 3 % KOH.

*Carolinigaster bonitoi* is related to species of *Austroboletus*, *Fistulinella*, *Veloporphyrellus* and *Mucilopilus* in the *Austroboletoidae*. *Mucilopilus castaneiceps* forms a sister clade to *C. bonitoi* but without support. *Mucilopilus castaneiceps* is a Japanese epigeous bolete that is superficially quite different from *C. bonitoi* but it actually shares some important features. Both taxa have dextrinoid spores, both have hymenial surfaces that are light when young but become dark pink or pinkish brown at maturity, and both fruit in association with trees in the *Fagaceae* (Takahashi 1988). The only other known truffle in the *Austroboletoidae* is *Soliococcus polychromus* (Trappe et al. 2013, Wu et al. 2016). *Soliococcus polychromus* is a brightly coloured tropical associate of *Myrtaceae* and *Fabaceae* that has smooth ellipsoid spores and is known only from Australasia.

No other bolete truffle has all of the same morphological features as *C. bonitoi* but the most similar taxon is *Jimtrappea guyanensis* (Smith et al. 2015). However, *J. guyanensis* is phylogenetically distant and has large, amyloid hymenial cystidia and smooth fusoid spores that are not dextrinoid, and is restricted to *Dicymbe*-dominated forests in Guyana.

*Carolinigaster bonitoi* is thus far known only from two collections from mixed, *Fagaceae*-dominated forests in North Carolina, USA. It is interesting that this species has not been found previously, particularly since Coker & Couch (1928) extensively studied the gasteromycetes (including hypogeous sequesterate species) of North Carolina. Coker & Couch (1928) recognized 26 species of '*Hymenogasteraceae*' in their book but none of the species they studied are similar to *C. bonitoi*.

For supplementary information see MycoBank.