= Volvopluteus earlei =

Volvopluteus earlei is a species of mushroom in the family Pluteaceae . It was originally described in 1911 by American mycologist William Alphonso Murrill as Volvariopsis earlei , based on collections made in a Cuban banana field . The fungus was later shuffled to the genera Volvaria and Volvariella before molecular studies placed it in Volvopluteus , a genus newly described in 2011 .

The cap of Volvopluteus earlei is typically between 2 @.@ 5 ? 5 cm (1 ? 2 in) in diameter , white , and is markedly viscid when fresh . The gills start out as white but they soon turn pink . The stipe is white and measures 5 cm (2 in) long and 1 cm (0 @.@ 4 in) wide . It has a smooth , white , sac @-@ like volva at its base . The cap produces a pinkish @-@ brown spore print made of individual elliptical spores measuring up to 11 micrometers long . A saprotrophic fungus that grows on grassy fields , V. earlei has been reported from Africa , Europe , and North America . Microscopic features and DNA sequence data are of great importance for separating this taxon from related species . V. earlei can be distinguished from the three other Volvariella by differences in the size of the fruit bodies , cap color , spore size , and the presence or absence and form of cystidia .

= = Taxonomy = =

This species was originally described by American mycologist William Alphonso Murrill in 1911 based on three collections made by his colleague Franklin Sumner Earle in Santiago de las vegas (Cuba) a few years earlier . It was originally described by Murrill in the genus Volvariopsis , created in the same publication , because at that time there was considerable confusion about which generic name was more appropriate for the mushrooms traditionally classified in the genus Volvariella . At the time of Murrill 's proposal most species in this group were classified in the genus Volvaria erected by Paul Kummer in 1871 , but mycologists realized that the name Volvaria was already taken as it had been coined by Augustin Pyramus de Candolle for a genus of lichens in 1805 . A year later Murrill transferred his species of Volvariopsis to the genus Volvaria , citing practical concerns about usage of names for non @-@ taxonomists : " A number of species of gill @-@ fungi described by me from tropical America in Mycologia , 1911 ? 1912 , under genera not found in Saccardo 's Sylloge , are here recombined for the benefit of those having or using herbaria arranged according to this work . Collectors , pathologists , and others who may not be intimately acquainted with taxonomic methods will probably find it more convenient to follow the one system until a comprehensive revison is completed , at least for some important groups " .

Ultimately , neither Volvaria nor Volvariopsis would be used as the correct name for this group . The generic name Volvariella , proposed by the Argentinean mycologist Carlos Luis Spegazzini in 1899 , would be adopted for this group in 1953 after a proposal to conserve Kummer ? s Volvaria against De Candolle ? s Volvaria was rejected by the Nomenclature Committee for Fungi established under the principles of the International Code of Nomenclature for algae , fungi , and plants . The combination Volvariella earlei would be made by Robert L. Shaffer , who authored the first comprehensive monographic revision of Volvariella in North America in 1957 .

The phylogenetic study of Alfredo Justo and colleagues showed that Volvariella earlei is closely related to Volvariella gloiocephala and that this group of species constitutes a separate lineage from the majority of the species traditionally classified in Volvariella . Therefore , this taxon was transferred to the newly proposed genus Volvopluteus . The specific epithet earlei comes from the surname of Franklin Sumner Earle , the collector of the original samples , to whom Murrill dedicated the species . The original specimens of this species are still preserved at the herbarium of the New York Botanical Garden .

= = Description = =

The cap of Volvopluteus earlei is between 25 and 50 mm (1 @.@ 0 and 2 @.@ 0 in) in diameter , more or less ovate or hemispherical when young , then expanding to convex or flat . It can have a low , broad umbo in the center in old specimens ; the surface is markedly viscid in fresh fruit bodies ;

the cap is pure white , but sometimes develops pale brown tinges with age . The gills are crowded together , free from attachment to the stipe , ventricose , and up to 6 mm broad ; they are white when young but turn pink with age as the spores mature . The cylindrical stipe is 30 ? 50 mm (1 @.@ 2 ? 2 @.@ 0 in) long and 2 ? 10 mm (0 @.@ 1 ? 0 @.@ 4 in) wide , and broadening towards the base . Its surface is white , smooth or slightly pruinose (as if covered with a fine white powder) . The sac @-@ like volva is up to 20 mm (0 @.@ 8 in) high , white and has a smooth surface . The context is white in the stipe and cap and it does not change color when bruised or exposed to air . The smell and taste of the flesh are described as indistinct or herbaceous . The spore print is pinkish @-@ brown .

The spores are ellipsoid and measure 11 ? 16 by 8 ? 11 µm . Basidia are 20 ? 40 by 8 ? 16 µm ; they are usually four @-@ spored but sometimes two @-@ spored , and , more rarely , one @-@ spored forms can occur . Pleurocystidia (cystidia on the gill face) are absent in most collections ; if present they are scarce and similar to the cheilocystidia . Cheilocystidia (cystidia on the gill edge) measure 30 ? 70 by 10 ? 35 µm , and are club- , spindle- , or flask @-@ shaped , and usually each one has an apical outgrowth up to 40 µm long . The cheilocystidia completely cover the gill edge . In the form acystidiatus (N.C.Pathak) Vizzini & Contu , both pleurocystidia and cheilocystidia are completely absent . The cap cuticle (pileipellis) is an ixocutis (parallel hyphae embedded in a gelatinous matrix) . The stipe cuticle (stipitipellis) is a cutis (parallel hyphae not embedded in a gelatinous matrix) . Caulocystidia (cystidia on the cap) are sometimes present ; they measure 65 ? 140 by 10 ? 25 µm , and are mostly cylindrical .

= = Habitat , distribution , and ecology = =

Volvopluteus earlei is a saprotrophic mushroom that grows in gardens and grassy fields . It was originally found in banana fields in Cuba . In Africa , Spain and Italy it has been reported mostly in urban or anthropogenic garden areas . It usually fruits in groups of several mushrooms but it can also be found growing solitary . This species has been reported from Cuba , North Carolina , Mexico , Spain and Italy . Molecular data have so far corroborated that the European and African collections correspond to the same species .

= = Similar species = =

Molecular analyses of the internal transcribed spacer region clearly separate the four species currently recognized in Volvopluteus , but morphological identification can be more difficult due to the sometimes overlapping morphological variation among the species . Size of the fruit bodies , color of the cap , spore size , presence or absence of cystidia and morphology of the cystidia are the most important characters for morphological species delimitation in the genus . Volvopluteus gloiocephalus has larger fruit bodies (cap more than 5 cm (2 in) in diameter) , has pleurocystidia , and the cheilocystidia lack long apical outgrowths . V. asiaticus has pleurocystidia and has predominantly flask @-@ shaped cheilocystidia without long apical outgrowths . In V. michiganensis , pleurocystidia are also present , and this species has smaller spores , typically less than 12 @.@ 5 µm long .