

= *Geastrum welwitschii* =

*Geastrum welwitschii* is a species of fungus in the earthstar family . When young and unopened , the fruit bodies resemble small spheres lying in the soil . As the mushroom matures , the thick leathery outer layer of tissue ( the peridium ) splits star @-@ like to form a number of fleshy arms , which curve downward to reveal the inner spore sac that contains the fertile tissue known as the gleba . The spore sac has a narrow grooved opening at the top where the spores are released . Fully expanded , the fruit bodies are up to 35 mm ( 1 @.@ 4 in ) wide and 58 mm ( 2 @.@ 3 in ) tall . First collected from Spain in the mid @-@ 19th century , the fungus is distributed in Europe , North America , and Bermuda .

= = Taxonomy = =

The fungus was first collected in Spain by the Austrian explorer and botanist Friedrich Welwitsch . British mycologist Miles Joseph Berkeley obtained the specimens and thought them to be *Geastrum fimbriatum* . He sent a specimen to the French mycologist Camille Montagne in 1856 , who named it *Geaster Welwitschii* ( *Geaster* is an orthographical variant of *Geastrum* ) . Patricio Ponce de León in his 1968 world monograph of *Geastrum* , considered the species a fornicate variety of *G. javanicum* , and described it as *Geastrum javanicum* var. *welwitschii* ; this is now a synonym .

According to Stanek 's infrageneric ( ranks below the level of genus ) concept of the genus *Geastrum* , *G. welwitschii* is classified in the section *Basimyceliata* , which includes species in which the outer part of the mycelial layer do not incorporate sand and encrusting debris . It is further classified in the subsection *Laevistomata* because its peristome ( an opening at the top of the spore sac ) is even to fibrillose ( with fibrils ) .

= = Description = =

The mature fruit body of *G. welwitschii* is small to medium @-@ sized , with a fornicate spore sac , meaning that the spore sac is raised into the air as the rays press down . Unlike some other earthstar fungi , the mycelial layer does not encrust debris as the fruit body develops . The peristome is even , and has an indistinct boundary . The young fruit bodies just prior to opening are found near the surface of the ground , and are rounded , with or without an umbo , and attached to the substrate with a basal mycelial tuft or cord . The expanded fruit body is small to medium @-@ sized . The fornicate exoperidium ( outer peridium ) has the upper , arched part ( fibrous and pseudoparenchymatous layers ) split to about the half @-@ way point or more into 4 ? 7 rays . The mycelial cup is free ( only attached at its base ) , with 4 ? 7 more or less well @-@ developed lobes corresponding to the 4 ? 7 rays . The width of the fruit body is about 20 ? 35 mm ( 0 @.@ 8 ? 1 @.@ 4 in ) , and in height about 40 ? 58 mm ( 1 @.@ 6 ? 2 @.@ 3 in ) ( including the 15 ? 20 mm high mycelial cup ) . The diameter of the exoperidium is about 39 ? 72 mm ( 1 @.@ 5 ? 2 @.@ 8 in ) .

The pseudoparenchymatous layer ( a layer of thin @-@ walled , usually angular , randomly arranged cells that are tightly packed ) is initially beige , later brownish , in age dark brown , cracked and if moist reddish @-@ brown . The fibrous layer is beige @-@ colored , with its outer side free from the mycelial layer except at the tips of the rays . The mycelial layer has a beige brown to somewhat yellowish @-@ brown , felted to tufted outer surface , darkening to reddish brown if moist . It is not encrusted with debris , but some debris and sand may adhere . The inner side is smooth , dull to somewhat glossy , and hazelnut brown .

The spore sac is stalked , and roughly spherical , with a diameter of about 8 ? 20 mm ( 0 @.@ 31 ? 0 @.@ 79 in ) . The stalk is short but distinct , up to 1 @.@ 5 mm ( 0 @.@ 059 in ) high , light beige in color , and sometimes indistinctly developed . The endoperidium ( inner peridium ) is more or less smooth to the unaided eye , but densely protruding light to grayish @-@ brown hyphal tips are present . The peristome is indistinctly delimited ( without distinct boundaries ) , and the mouth area fibrillose . The columella is not well @-@ developed , and broadly club @-@ shaped to columnar ;

in cross @-@ section it is whitish to pale beige . The mature gleba is brown and powdery .

The spores of *Geastrum welwitschii* are roughly spherical , sometimes contain an oil droplet , and measure 4 @.@ 5 ? 5 @.@ 5 ?m in diameter . Scanning electron microscopy has revealed that the spore surface is covered with column @-@ like processes , up to 0 @.@ 45 ?m high , that may be more or less confluent .

= = Similar species = =

*Geastrum welwitschii* is morphologically similar to *G. fornicatum* in having fornicate , mostly 3 ? 6 rays , of exoperidia and a cup @-@ shaped mycelial layer . *Geastrum welwitschii* is distinguished from *G. fornicatum* by its epigeal mycelial cup with a felted or tufted outer surface .

*Geastrum welwitschii* also has similar morphological characters to *G. minimum* in having small fruit bodies , whitish spore sacs , and fibrillose peristomes . However *G. welwitschii* is differentiated from *G. minimum* by its fornicate , mostly 3 ? 6 , rays of the exoperidia , and the mycelial layer that easily loosens from the fibrous layer to form a mycelial cup . *G. welwitschii* is distinguished from *G. entomophilum* by its dark and sessile endoperidium , and smaller spores ( 2 @.@ 8 ? 3 @.@ 5 ?m ) .

According to mycologists Hemmes and Desjardin , the most common earthstar in the coastal Casuarina forests of Hawaii is a species " closely allied " with *G. welwitschii* , which they name *Geastrum aff. welwitschii* . It differs from the main species in its much coarser pyramidal warts on the exoperidial surface , a sessile and sac @-@ shaped endoperidial body , and smaller spores . They likened the roughened outer surface of the exoperidium to lychee fruit .

= = Habitat and distribution = =

The fungus is saprobic , and grows on the ground , in leaf litter , or on decomposing wood . It has been collected in Spain , South Carolina , Florida , and Bermuda .