

MUSHROOM SERIES

STARS OF THE GROUND – THE EARTHSTARS

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A specimen of Geastrum quadrifidum reported from La Ronge, SK (Sasata 2010). Note how the arms are reflexed to raise up the spore sac. The mycelial mat below is embedded with litter.

“Earthstar” is an oxymoron; stars are in the sky, born in the universe, not sitting on the ground having emerged from the earth. But the Latin and Greek roots to their name, “Geastr”, mean exactly that: earth (Ge-, as in ‘geography’) and star (astr-, as in those starry ‘aster’ flowers). Earthstars are basically a fancy puffball with two layers: the outer

peridium splits apart in high humidity and opens up to form a star-like shape, while the inner peridium stays intact so an ordinary puffball sits inside.

The star serves a few purposes. Since the outer peridium only opens at maturity and in wet conditions, the spores are only released when they are fully

formed and have the best chance for germination, otherwise the inner spore sac is shielded and spore release is prevented. Some earthstars will only do this once. Others can open and close multiple times, such as the well-known earthstar *Astraeus hygrometricus* known as the water measurer or barometer earthstar (hygr- meaning moisture or humidity, metr- for metric, measuring) (Arora 1986).

Often the points of opened stars will reflex, propping up the spore sac with the arms of the star acting like stilts. The added height of a couple centimeters above ground level can substantially improve spore dispersal. *Geastrum quadrifidum* (four-armed earthstar) is known for this dramatic ballerina-like pose. The epithet fits the common name (quadr- fourfold, fid- divided) but sometimes the star splits five ways. This species also has a little support stalk below the spore sac and a distinct beak around the mouth area (peristome) (Baron 1999).

I remember years ago when I encountered earthstars for the first time. I was in a pine stand and they were scattered all over the needle bed on the ground. It looked like someone dropped a basket of them; they didn't seem

to be connected to the ground at all. Apparently some can roll around like tumbleweed after they are fully grown (in dry conditions when closed). My earthstars were completely dry, closed like a tight fist as David Arora would describe (Arora 1986). When I got home I put them in a bowl of shallow water, and sure enough when I checked a few minutes later they had opened! I played with them, tapping the spore sac inside and watching the little brown eruptions. My sister was horrified.

Like most fungi, taxonomy of earthstars is in a process of correction in recent years. Though earthstars would seem to all be closely related, convergent evolution has apparently taken place for this morphological form. The genus *Geastrum* sits next to stinkhorns, corals, and *Gomphus* (wooly chanterelle) in the gomphoid-phalloid clade on the fungus phylogenetic tree of life (Pine et al. 1999). Meanwhile *Astraeus* earthstars are more closely related with boletes (fleshy mushrooms with pores instead of gills). Michael Kuo insists there must be an ecological reason for these strange groupings (Kuo 2004). Perhaps both *Astraeus* and boletes have always been fond of associating with pine roots. The ecology theory seems like a reasonable idea to me but hasn't

been studied yet. It is likely there aren't enough collections or ecological notes associated with them.

Earthstar taxonomy has also had amendments at the species level. *Astraeus hygrometricus* used to be considered a widespread species across the globe, but has since been split into several different species. Luckily many of these phylogenetic divisions correspond directly with geography, such as the newly created species *A. morganii* encompassing North American collections of "*A. hygrometricus*" (Phosri et al. 2013). Other species from this split are found exclusively in Europe or Asia.

Earthstars are often found in areas with sandy soil and near trees (either hardwood or conifer). After you find them once, you will know when you are in the right area. When you see one, count the number of rays on the star, see if the spore sac has a beak and a stalk, and really, note anything else interesting and unique about it. If you are in an area where collection is permitted, take one home! You can do the barometer test and see if it continues to open and close. At the least, your specimen will make an interesting conversation piece on your mantle.

REFERENCES

Arora D. (1986) *Mushrooms Demystified*. 2nd Ed. Ten Speed Press, Berkeley, California.

Barron G. (1999) *Mushrooms of Ontario and Eastern Canada*. Lone Pine Publishing, Edmonton, Alberta. p. 91-96

Kuo, M. (2004) *The Phallales*. Retrieved from the MushroomExpert.Com Web site: <http://www.mushroomexpert.com/phallales.html>

Phosri C, Martín MP, Watling R. 2013. *Astraeus*: hidden dimensions. *IMA Fungus* 4(2): 347–356. doi:10.5598/imafungus.2013.04.02.13

Pine EM, Hibbett D, Donoghue MJ. 1999. Phylogenetic relationships of cantharelloid and clavarioid Homobasidiomycetes based on mitochondrial and nuclear rDNA sequences. *Mycologia* 91: 944-963.

Sasata, R. 2010. *Geastrum quadrifidum* Pers. (46881). <http://mushroomobserver.org/46881> [Photo redistributed under CC BY-SA 3.0 license. URI: <<http://creativecommons.org/licenses/by-sa/3.0/>> Image URL: <<http://images.mushroomobserver.org/orig/89495.jpg>>]