

Artificial Key to Arizona Earthstars (Geastraceae and *Astraeus*)

- 1a. Endoperidial body supported by several stalks, having multiple stomata; spores reticulate; exoperidium lustrous *Myriostoma coliforme*
- 1b. Endoperidial body sessile or supported by a single stalk, having a single stoma; spores not reticulate; exoperidium not lustrous 2
- 2a. Gleba containing numerous thin or thick-walled paracapillitia, eucapillitia lacking; spores echinate to verrucose; endoperidium reticulate, particularly on the lower portion of the endoperidial body 23. *Astraeus hygrometricus*
- 2b. Gleba containing numerous thick-walled eucapillitia; spores verrucose, but not echinate; endoperidium not reticulate 3
- 3a. Peristome fibrillose 4
- 3b. Peristome plicate 18
- 4a. Gasterocarp fornicate 5
- 4b. Gasterocarp not fornicate 6
- 5a. Peristome disc-shaped, distinctly delimited by a raised rim; endoperidium lacking pigmented protruding hyphae; gasterocarp of small to medium stature (less than 35 mm in height); spores 5.6-6.4 μm in diameter (including ornamentation)
..... *Geastrum quadrifidum*
- 5b. Peristome not disc-shaped, nor distinctly delimited or only faintly so, lacking a rim; endoperidium densely covered with thick, pigmented protruding hyphae; gasterocarp of medium to large stature (greater than 35 mm in height); spores 4.8-5.6 μm in diameter (including ornamentation) *Geastrum fornicatum*
- 6a. Endoperidial body sessile 7
- 6b. Endoperidial body stalked 14

7a. Mycelial layer present (membranaceous or encrusted); rays sub to non-hygroscopic	9
7b. Mycelial layer lacking; rays hygroscopic	8
8a. Peristome distinctly delimited; spores 4.8-5.6 μm in diameter (including ornamentation)	<i>Geastrum corollinum</i>
8b. Peristome not distinctly delimited; spores 5.6-7.2 μm in diameter (including ornamentation)	<i>Geastrum floriforme</i>
9a. Peristome distinctly delimited	10
9b. Peristome not distinctly delimited	13
10a. Endoperidial body ringed by a pseudoparenchymatous collar; gasterocarp saccate	<i>Geastrum triplex</i>
10b. Endoperidial body not ringed by a pseudoparenchymatous collar; gasterocarp saccate or not	11
11a. Gasterocarp not saccate; peristome darker than endoperidial body, lacking a rim; mycelial layer heavily encrusted with debris or particles of soil or sand, not splitting radially along rays; spores 3.2-4.0 μm in diameter (including ornamentation)	1. <i>Geastrum arenarium</i>
11b. Gasterocarp saccate; peristome concolorous with endoperidial body, distinctly rimmed; mycelial layer membranaceous, not encrusted with debris or only lightly so, often splitting radially along rays; spores 4.0-5.6 μm in diameter (including ornamentation)	12
12a. Gasterocarp small to medium stature (less than 35 mm in width); spores 4.0-4.8 μm in diameter (including ornamentation); spore mass light brown; tips of rays narrow	<i>Geastrum lageniforme</i>

- 12b. Gasterocarp of medium to large stature (greater than 30 mm in width); spores 4.8-5.6 μm in diameter (including ornamentation); spore mass dark brown; tips of rays narrow or truncate *Geastrum saccatum*
- 13a. Spores 3.2-4.0 μm in diameter (including ornamentation); gasterocarp of small to medium stature (less than 30 mm in height), often saccate; pseudoparenchymatous layer lacking reddish tints when fresh; fibrous layer papery to coriaceous
..... *Geastrum fimbriatum*
- 13b. Spores 4.8-5.6 μm in diameter (including ornamentation); gasterocarp of medium to large stature (greater than 25 mm in height), never saccate; pseudoparenchymatous layer having reddish tints when fresh; fibrous layer coriaceous to rigid
..... *Geastrum rufescens*
- 14b. Mycelial layer membranaceous, not encrusted with debris or only lightly so; gasterocarp often pseudofornicate *Geastrum smardae*
- 14a. Mycelial layer lacking or not membranaceous, if present then heavily encrusted with debris; gasterocarp never pseudofornicate **15**
- 15a. Peristome distinctly delimited **16**
- 15b. Peristome not distinctly delimited **17**
- 16a. Endoperidial body having a dense pruinose layer of crystalline matter; spores 4.8-6.4 μm in diameter; peristome distinctly delimited but not ringed by a pale zone; gasterocarp of small to medium stature (less than 25 mm in height)
..... *Geastrum minimum*
- 16b. Endoperidial body not having a dense pruinose layer of crystalline matter, or only finely so; spores 5.6-6.4 μm in diameter; peristome distinctly delimited and often ringed by a pale zone; gasterocarp of medium to large stature (greater than 20 mm in height) *Geastrum coronatum*

- 17a. Endoperidium covered with dark, persistent, coarse, granular, irregular-shaped to spiny projections; pseudoparenchymatous layer not having reddish tints when fresh; spores 4.0-4.8 μm in diameter (including ornamentation) *Geastrum hieronymi*
- 17b. Endoperidium not covered with dark, persistent, coarse, granular, irregular-shaped to spiny projections; pseudoparenchymatous layer having reddish tints when fresh; spores 4.8-5.6 μm in diameter (including ornamentation) *Geastrum rufescens*
- 18a. Endoperidial body sessile 19
- 18b. Endoperidial body stalked 21
- 19a. Mycelial layer lacking; rays hygroscopic; endoperidium verrucose
..... *Geastrum kotlabae*
- 19b. Mycelial layer present; rays sub- to non-hygroscopic; endoperidium not verrucose
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- 20a. Endoperidial body having a dense pruinose layer of crystalline matter when fresh; endoperidium glabrous; rays not truncate or broken off at tips
..... *Geastrum elegans*
- 20b. Endoperidial body not having a dense pruinose layer of crystalline matter when fresh; endoperidium minutely furfuraceous (hyphal protrusions visible only under magnification); rays often truncate or broken off at tips
..... *Geastrum xerophilum*
- 21a. Exoperidium verrucose; rays hygroscopic, occasionally only weakly so; spores 6.4-8.0 μm in diameter (including ornamentation); fibrous layer coriaceous to rigid
..... *Geastrum campestre*
- 21b. Exoperidium not verrucose; rays sub to non-hygroscopic; spores 4.8-6.4 μm in diameter (including ornamentation); fibrous layer coriaceous 22

- 22a. Endoperidial body not having a pruinose layer of matted hyphal elements and/or crystalline matter when fresh; rays often truncate or broken off at tips
 ***Gastrum xerophilum***
- 22b. Endoperidial body having a pruinose layer of matted hyphal elements and/or crystalline matter when fresh; rays not truncate or broken off at tips **23**
- 23a. Spores 5.6-6.4 μm in diameter (including ornamentation); apophysis not forming a ridged collar ***Gastrum schmidelii***
- 23b. Spores 4.8-5.6 μm in diameter (including ornamentation); apophysis forming a ridged collar or not **24**
- 24a. Apophysis forming a ridged collar; peristome plicate, not delimited or only faintly so, conical and coming to a point at apex; gleba reddish brown
 ***Gastrum striatum***
- 24b. Apophysis not forming a ridged collar; peristome deeply plicate, distinctly delimited and often recessed, applanate, often raised in central portion to a short, narrow point; gleba dark brown ***Gastrum smithii***