

THE  
GEASTRAE.

ILLUSTRATED WITH 80 FIGURES.

BY C. G. LLOYD.

CINCINNATI, OHIO, U. S. A.

JUNE, 1902.

W. G. FARLOW



## GEASTRAE.

We have classed the Geastrae as a sub-tribe of the Lycoperdeae, the essential characters of which are plants sessile, spores mixed with capillitium. (See "The Genera of Gastromycetes, p. 11.)

Geastrae differ from the other Lycoperdeae in having the outer peridium thick, permanent, and when the plant ripens the outer peridium peels away from the inner, splits into segments and becomes more or less recurved or spreading.

### THE MYCELIUM.

There are two distinct types of mycelium. Most Geastrae develop under the ground and the mycelial threads proceed from every portion of the outer peridium binding it to the soil. This is the usual type of most Geaster mycelii. In some species however, (see Fig. 57) the mycelium proceeds only from the base of the plant, and has the appearance of large cord-like roots.

### THE OUTER PERIDIUM.

There are three distinct layers forming the outer peridium of a Geaster and they are quite evident to anyone who will closely observe them.

- 1st, the mycelial or outer layer,
- 2nd, the fibrillose or middle layer,
- 3rd, the fleshy or inner layer, also called the Collenchyma.

THE MYCELIAL LAYER.—This derives its name from the fact that in many cases in the growing plants, mycelium threads proceed from all parts of it and bind the plant to the surrounding soil. In plants of the section *Rigidae* it is fragile, and so closely attached to the soil that as the plant expands it tears away from the mycelial layer which remains attached to the soil. In herbarium specimens (see Fig. 8) of *Geaster hygrometricus* and others of the *Rigidae*, the outer peridium appears smooth, the mycelial layer having entirely disappeared. In most Geasters however, the mycelial layer remains more or less firmly attached to the fibrillose but the degree of attachment in different specimens, otherwise the same, is of no importance, merely a condition. In *Geaster limbatus*, most of the specimens have the two layers adnate but we have specimens that have the mycelial layer only slightly attached at the extremities of the segments, and specimens also where it has entirely peeled off. In some species, (*fornicatus coronatus*, *radicans* in particular) the mycelial layer remains as a cup, the fibrillose layer separates and arches up, tearing away, except at the tips of the segments which remain attached. Species with this character are called fornicate, and as it seems to have been supposed to have been the character of only one species called *fornicatus*, several have been confused under this name. As a matter of fact quite a number of species have this character in a more or less perfect degree. All Geasters have an outer layer which



for uniformity we call the mycelial layer, though inaccurately so-called in cases like *G. radicans* where the mycelium is basal.

THE MIDDLE OR FIBRILLOSE LAYER.—This is usually the thickest and principal layer of the outer peridium and in many herbarium specimens is the only one that remains, the outer and inner layers having peeled off and disappeared. Its nature varies much in different species. In the *Rigidae* it is firm, thick, strongly incurved when dry, and strongly hygroscopic. When the plant is moist the segments reflex, and they curl in again when dried, and the process can be repeated as often as the plants are moistened and dried. Fig. 5 represents a dried plant as found in the herbarium, Fig. 6 is the same plant after having been moistened. All Geasters are to an extent hygroscopic and the simplest way to make a crushed specimen assume its normal shape is to place it a few minutes in a jet of free steam which puffs them out plump and natural. The photographs of many of the specimens we present would not be supposed to be the same specimen we received. In most species of Geaster the fibrillose layer instead of being firm as in *Rigidae* is to an extent flexible and in the only specimen we have seen of "*G. turbinatus*" it resembles parchment paper.

THE INNER OR FLESHY LAYER.—This layer differs very much from both of the preceding. When the plant opens it is thick, soft, fleshy, usually white or pinkish. As it dries it almost always turns dark reddish brown, dries down to a thin adnate layer, or splits up and peels off entirely or partially. A photograph of a Geaster taken with this layer fresh is quite different from the photograph of the dried specimen of the plant. Sometimes instead of drying down to a thin layer, if exposed to the weather it thickens, becomes spongy, torn. This is particularly the character of the fleshy layer of *G. rufescens*. In many species if specimen of the plant be dried when it first opens, the fleshy layer remains as a thin red adnate layer, whilst if left exposed to the weather the layer peels off and disappears entirely. Specimens collected in these different conditions appear like different plants. Sometimes the fleshy layer separates from the fibrillose, and remains as a kind of cup at the base of the inner peridium. This is purely an accidental character and while present in many specimens (see Fig. 47) is absent in others. It is the basis for such species as *G. triplex*, and made the *key character* in Saccardo. While we consider *G. triplex* a good species, it is on entirely different points from this feature, from which it receives its name.

Fig. 60 shows a specimen of *G. coronatus* in which a portion of the fleshy layer in peeling off has chanced to tear in a circumscissile manner and dried as a separate ring, which being too small to slip over the inner peridium remains as a loose collar at its base. It is needless to say that this is purely accidental and might never occur in another specimen.



## THE INNER PERIDIUM.

The inner peridium of Geasters is generally dull, flaccid, soft. It is either globose or more or less ovate, often tapering to the base. Sometimes it is pedicellate, sometimes sessile and this feature is a primary character in several authors' classification. I do not however, feel that it is of primary importance for I think the length of the pedicel, in some species, is dependent largely on the extent that the outer peridium is reflexed or drawn away from the inner. *Geaster rufescens* I believe varies in having the inner peridium sessile or distinctly pedicellate.

THE MOUTHS OF THE INNER PERIDIUM are of three types. 1st, not defined but simply a torn aperture; 2nd, distinct, usually conical, but even. 3rd, strongly sulcate. I think Geasters are more strongly characterized by their mouths than by any other feature. In addition some Geasters have the mouths seated on a definite circular area strongly marked, and differing in shade of color from the balance of the inner peridium. Such mouths we call definite. In others the mouth is conical and distinct but is not marked with a definite area. Such we call indefinite. While the various species are characterized by having in general definite or indefinite mouths we think it is not rare that individual plants of a species usually having indefinite mouths may have a definite mouth or vice versa.

In addition to these characters above we read of "dentate" mouths especially in connection with *G. rufescens*, and such a mouth is clearly shown on Schmidel's drawing. We believe however, that it is purely in error, and as that error has been handed down in our descriptions for 150 years it is time we were rid of it.

We also read of fimbriate mouths, especially in connection with *G. fimbriatus*. Most Geasters of the even-mouthed series have appressed hairs around the mouth, and when the plant is old and weather worn these hairs become frayed and take on a fimbriate appearance, but that it is a character, I do not believe.

We have seen specimens with an even mouth, rimose, and appearing at first sight as if sulcate. That is simply the result of the way the plant dries and its occurrence is rare. It was from such a specimen Schaeffer (1761) drew his figure on which *G. coronatus* (fornicatus of many authors) was based, and hence the error that persists for 140 years that "*Geaster fornicatus* has a sulcate mouth." No fornicate species of Europe has to my knowledge a sulcate mouth.

"Pectinate" mouth is a term used in connection with Geasters. A pectinate mouth would be composed of narrow segments set parallel like the teeth of a comb. Such mouths are often shown in illustrations, as in Chevallier's cut of "*G. minimus*" and in Masee's beautiful but inaccurate figures of Geasters in the *Annals of Botany*. We do not think that such a mouth occurs in nature but are exaggerated conceptions of sulcate mouths. A plant with a sulcate mouth might have the divisions broken apart and thus become "pectinate," but we have never seen one and do not believe they occur.



## CAPILLITIUM.

With the exception of the anomalous species, *hygrometricus*, the capillitium of Geasters consists of long unbranched threads that proceed from the columella and inner surface of the peridium.

The capillitium, in some species at least, is more firmly attached to the peridium and columella than usual in most Gastromycetes. Cut open a Geaster, shake out the spores, and with a hand glass abundant capillitium can be seen proceeding from both columella and peridium. Fragments of these threads are mixed with the spores, and these fragments as seen under the microscope are usually simple, cylindrical and tapering. The relative thickness of the threads as compared to the spores, we give in our descriptions as a matter of form. We place little value on it however, as the threads as well as the spores may vary in thickness.

## SPORES.

With the exception of the anomalous species, *hygrometricus*, the spores of the species we have examined are very similar, all globose, all slightly warted, all about 3-5 mc. in diameter. Some are slightly larger than others, some slightly rougher than others, but the differences while evident by contrast are not sufficient to determine specific characters. Cooke describes species from Australia with "smooth" spores. We have never seen a perfectly smooth spore in a Geaster. *G. hygrometricus* can be known at once by its large rough spores 8-12 mc. in diameter.

The color of the spore mass of Geasters affords no distinction as it does in other genera. We find no species with pronounced olive or purplish spores. The usual color is a dark brown deepening to black.

## COLUMELLA.

In our opinion one of the most striking points of difference between species is the shape of the columellæ, which varies from ovate, globose, or filiform. To study the columellæ however, the plant should be examined just before it expands. After the spores ripen the columellæ usually become indistinct. Vittadini seems to have been the only author who has observed and illustrated the columellæ in his plates.

## SHAPE OF UNEXPANDED PLANT.

If we knew the shapes of the unexpanded plants, the best primary division of the genus would be in two sections. Plants with unexpanded forms, globose (see Fig. 41) and plants with unexpanded form, acute (see Figs. 48, 77). Unfortunately, however, we only know the unexpanded form of a few species, simply from lack of observation. We call attention of collectors especially to this point that in gathering Geasters it is particularly important to secure a few unexpanded plants or to make a note of their form. We hope should we issue a second edition of this pamphlet that we may have the data, and not be forced to admit our ignorance on this character of many of the species.



## CLASSIFICATION.

The Geastrae consist of only two Genera, *Myriostoma* with but a single widely distributed species, and *Geaster* of which we are familiar with 22 species, and know imperfectly several others.

*Geaster hygrometricus* differs from other species widely in its internal structure. It has no columella, (neither has other species) the capillitium is branched and interwoven and in mature specimens scanty as compared to other species; the spores are larger and approximate the spores of *Scleroderma*, and the spore mass closely resembles to the eye that of a *Scleroderma*. In De Bary's *Morphology* (English, 1887, pp. 313 and 314,) the points are clearly brought out. Morgan (1889) proposed for it the name *Astraeus*. Desveaux had many years before (1809) proposed the same thing and Corda (*Icones* Vol. 5) elaborated it, only they retained the name *Geaster* for this species, proposing to change the other species to *Pleastoma*. We do not feel that *Geaster hygrometricus* ought to be separated from other species which it so closely resembles in general appearance that it was for years confused with them, and which to-day frequently requires the use of the microscope to distinguish from other species. We certainly do not think it ought to be put in a different order (we do not use the word natural) as Fischer proposes, and if we did we would not put *Nidulariaceae* between it and *Geaster*.

### KEY TO GENERA.

Mouths and pedicels several . . . . . *Myriostoma*.  
Mouth and pedicel one . . . . . *Geaster*.

### MYRIOSTOMA COLIFORMIS.

Exoperidium usually recurved, cut to about the middle to six to ten lobes; if collected and dried when first open rather firm and rigid; when exposed to weather, becoming like parchment paper by the peeling off of the inner and outer layers. Inner peridium, subglobose, sup-

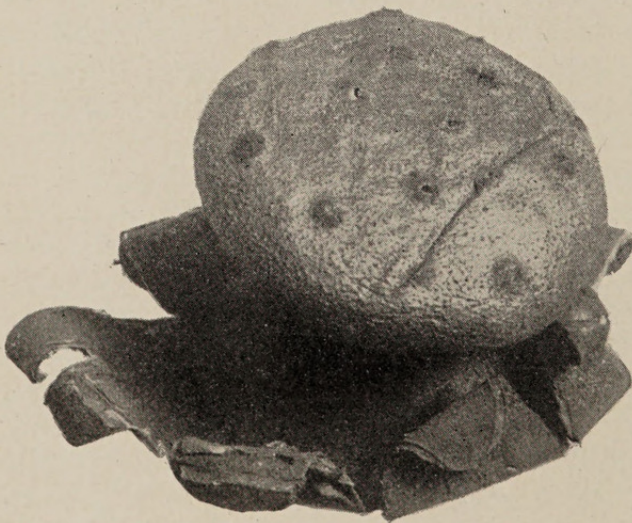


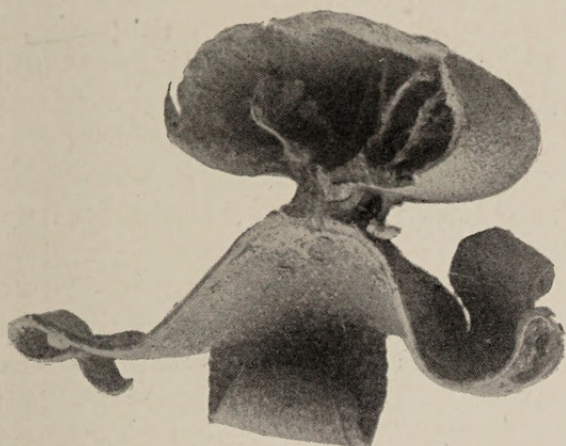
Fig. 1.  
*Myriostoma coliformis*.



Fig. 2.  
*Myriostoma coliformis*.

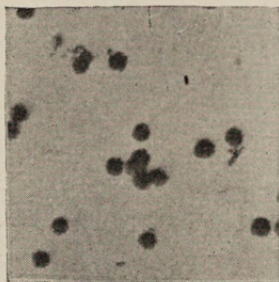


ported on several, more or less confluent, pedicels. Surface minutely roughened; mouths several, appressed fibrillose, round, plain or slightly elevated; Columellae several, filiform, probably the same in number as the pedicels; spores globose, roughened, 3-6 mc.; capillitium simple, unbranched, long, tapering, about half diameter of spores.



**Fig. 3.**

*Myriostoma coliformis* (section showing columellae.)



**Fig. 4.**

*Myriostoma coliformis*, (spores magnified.)

The inner peridium with its several mouths can be, not inaptly, compared to a "pepper-box." The specific name is derived from the latin *colum*, a strainer, and the old English name we find in Berkeley "Cullenden puff-ball" refers to a cullender (or colander more modern form) now almost obsolete in English but meaning a kind of strainer. This plant is first mentioned by Doody (in the appendix to Ray's Syn. 2nd Ed., 1696.\*) Dickson (†) 1785, beautifully illustrated the plant and as it is such an odd plant it has never been confused in literature. Dickson called it *Lycoperdon coliforme*. Persoon (Syn. 1801) refers it to *Geaster*, and Desveaux (1809) proposed for it the genus *Myriostoma*. At the present day it is generally known as *Myriostoma coliformis*, though some writers (strangely to our mind) still continue to call it *Geaster coliformis*.

### Geographical Distribution.

In Europe the plant is reported from England, Holland, Germany, and Poland, and develops abundantly in the sandy plains of Hungary. In England it is a very rare plant. In this country species were sent to Chas. Peck from Colorado. We have it from Dakota and abundantly from Florida.

### Specimens in our Collection.

*Florida*, (many specimens) Mrs. Delia Sams.

*Dakota*, Black Hills, Prof. T. H. McBride.

*Hungary*, magnificent specimens, Dr. L. Hollos.

### Explanation of Figures.

Figs. 1 and 2 plants natural size; Fig. 3 Section showing columellae; Fig. 4 Spores magnified 450 diameters. Specimens all from Mrs. Delia Sams, Florida. All figures in this pamphlet are natural size unless otherwise specified. All micro-photographs are by Dr. Edward H. Thompson.

(\*) The previous citations of Ray to Merrett (1667) is more probably a *Geaster*.

(†) Fasc. Plant, Cryp. Britanniae.



# GEASTER.

Exoperidium thick, divided into sections and usually recurved away from the inner peridium. Inner peridium sessile or stipitate with a single pedicel. Mouth only one. Capillitium (mostly) simple, unbranched. Spores globose, rough. We would divide the genus primarily into two sections.

Rigidae (see following).

Non-Rigidae (see page 14).

## SECTION 1. RIGIDAE.

Exoperidium rigid, strongly incurved when dry, strongly hygroscopic.

This section is a very natural division of the genus readily recognized by the rigid incurved exoperidium segments of the dried specimens. All species of Geaster are hygroscopic to a more or less extent, but these are strongly hygroscopic. The mycelium covers the entire young plants and the layer is thin. When the plant expands the mycelium layer tears off and remains as fragments attached to the soil, hence the plants of this section as found in collections are smooth externally, and entirely devoid of mycelial layers.

Spores large, (8-12 mc.)

(1) hygrometricus.

Spores small, (4-6 mc.)

Mouth indeterminate,

(2) delicatus.

Mouth strongly sulcate,

(3) Drummondii.

Mouth definite, even,

(4) mammosus.

## 1. GEASTER HYGROMETRICUS.

Unexpanded plant globose. Mycelium layer, thin, tearing away as the plant expands. Fibrillose layer thick, rigid, strongly hygroscopic, splitting into six to twenty segments becoming reflexed when the plant is moist; strong incurved and rigid when dry. Flesh layer thin, soon separating and often absent from herbarium specimens. Inner peridium globose, thin, opening by simply a torn aperture; columella none. Capillitium threads long, branched, about half diameter of largest spores. Spores large, globose, rough, 8-12 mc.

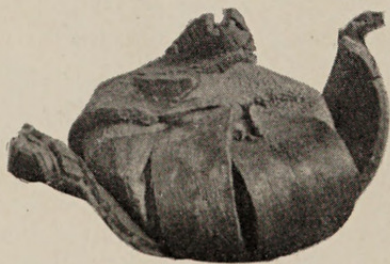


Fig. 5.

Geaster hygrometricus (dried specimen.)

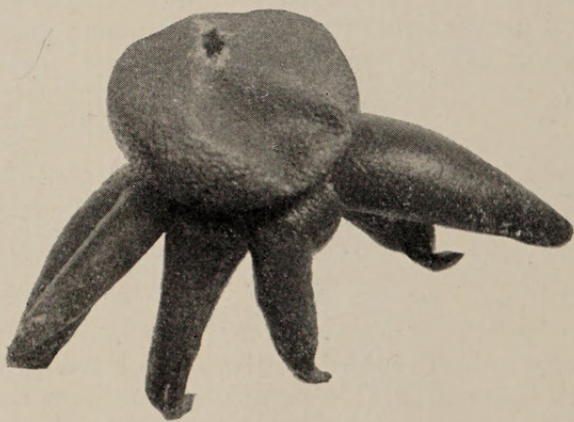
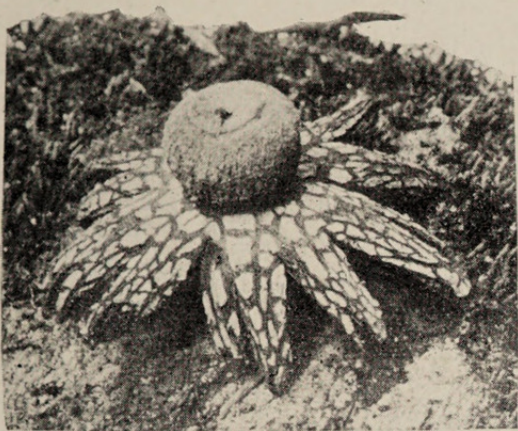


Fig. 6.

Geaster hygrometricus (expanded specimen.)



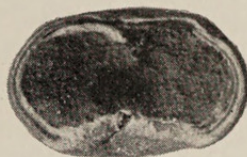
This plant is fond of sandy localities and very common in many places. It develops under the ground and is of slow growth. Young plants received from W. N. Suksdorf grew in clumps, (see fig. 10)



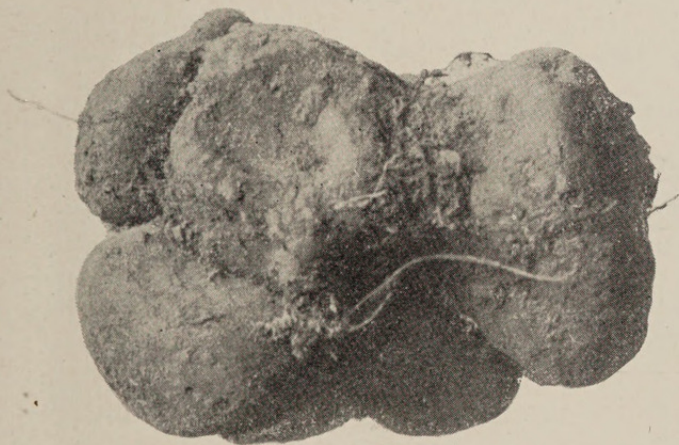
**Fig. 7.**  
Geaster hygrometricus (as it grows.)



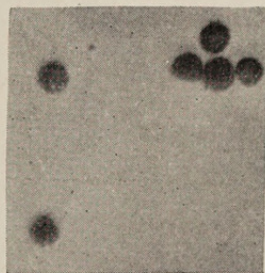
**Fig. 8.**  
Geaster hygrometricus (unexpanded.)



**Fig. 9.**  
Geaster hygrometricus (section, unexpanded.)



**Fig. 10.**  
Geaster hygrometricus (unexpanded, caespitose plants.)



**Fig. 11.**  
Geaster hygrometricus (spores magnified.)

but that this is exceptional, or usual, we do not know. The young plants are liable to be taken at first for a species of hypogaeal fungi, or on examination under a microscope for an undeveloped Scleroderma. The genus Diploderma was based on unopened specimens of this plant and Cycloderma on unopened specimens of other Geasters. The general resemblance of the spore glass to that of a Scleroderma is close, for the large rough spores are very similar, and the capillitium is so relatively scanty, that when a piece of gleba is pressed on a glass often only spores can be seen. The capillitium however can be readily floated out by method described in foot note on page 7 of "Gastromycetes Genera."

The plant ripens in late summer or fall of the year, and the thick outer peridium splits into segments, sometimes as few as four, sometimes as many as twenty. They are strongly hygroscopic and in moist weather recurve and standing on their tips lift up the inner ball. In



dry weather they closely curve in, clasping the ball, and they will repeat this as often as the conditions become moist or dry. Hence they are called "hygrometricus" and frequently by children "poor-man's weather-glass." Miss Marshall in St. Nicholas states that in the closed condition they are carried along by the wind and applies to them the name of "Fair weather travellers." Plants persist often during winter and one observing them in the spring expanding under the influence of moisture may take them for growing plants. They become "weather-worn," the inner surface of the exoperidium cracked in numerous areas, the surface of the inner peridium frayed and fibrillose. It is a weather-worn specimen that Schweinitz named "Geaster fibrillosus."

#### Geographical Distribution.

The plant is cosmopolitan. Common throughout Europe, it is more rare in England than on the continent. In this country it occurs from coast to coast and from Canada to Mexico. Locally however, it has never been found in the immediate vicinity of Cincinnati.

#### Specimens in our Collection.

*Massachusetts*, Miss Cora Clarke, Mrs. Chas. Cheney, Simon Davis, Walter Deane. *Connecticut*, James B. Rorer. *New York*, Ella K. Hays. *Pennsylvania*, Ellen M. Dallas. *Maryland*, C. L. Shear. *Minnesota*, Minn. Bot. Survey. *Tennessee*, S. F. Corly. *Georgia*, Roland M. Harper. *Florida*, Mrs. Delia Sams, H. C. Culbertson, P. H. Rolfs, C. G. Lloyd. *Colorado*, C. F. Baker. *Washington*, W. N. Suksdorf. *Illinois*, L. H. Watson.

*France*, N. Patouillard, F. Fautrey. *Tirol*, Rev. G. Bresadola. *Hungary*, Dr. L. Hollos.

#### Explanation of Figures.

Fig. 5. A plant of our collection from Walter Deane, Cambridge, Mass. Fig. 6. The same plant when moistened. Fig. 7. Photograph of plant in situ, by F. J. Braendle, Washington, D. C. Fig. 8. Unexpanded plant. Fig. 9. Section of same. Fig. 10. A cluster of unexpanded plants, from W. N. Suksdorf, Washington. Fig. 11. Spores magnified 450 diameters.



Fig. 12.

*Geaster hygrometricus* var. *giganteus*, (unexpanded)

### GEASTER HYGROMETRICUS VAR. GIGANTEUS.

A large form, differing from the ordinary plant only as to size, frequently reaches us from the Western States. It is so much larger than the usual plant that we think is entitled to a distinctive name. This large plant does not grow in Europe to our knowledge.



Specimens in our  
Collection.

California, L. A. Greata.

Washington, W. N. Suksdorf.

Iowa, T. H. McBride.

Explanation of  
Figures.

Fig. 12. *Geaster hygrometricus* var. *giganteus*, specimen, from L. A. Greata, Los Angeles, Cal.

Fig. 13. The same after expanding by moisture.

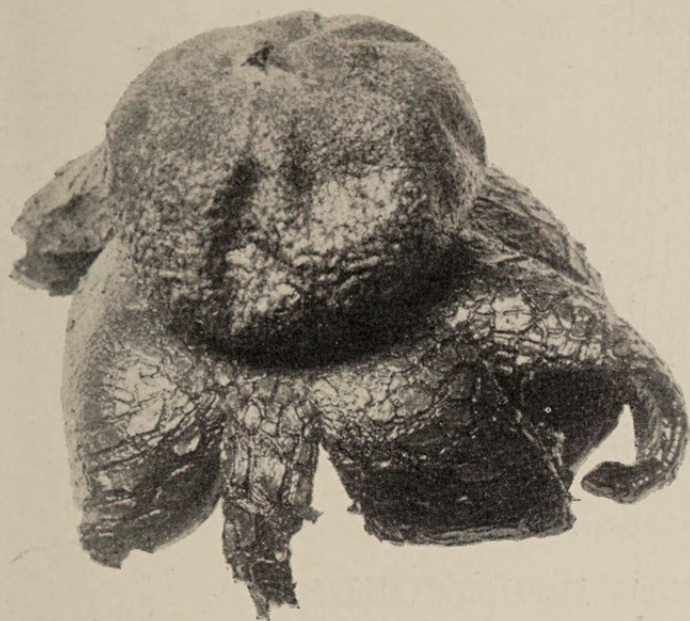


Fig. 13.  
*Geaster hygrometricus* var. *giganteus* (expanded.)

## 2—GEASTER DELICATUS.

Outer peridium thin, smooth, firm, hygroscopic, cut (about  $\frac{2}{3}$  deep) to 8–10 segments. Spreading when moist, incurved when dry. Inner peridium subglobose, opening by a plane, indefinite aperture. Columella none. Capillitium slender, interwoven, simple or sometimes slightly branched near the end, slightly thinner than the spores. Spores globose, minutely warted, 5–6 mc.

This elegant little species is known only from the Northwest. It was described by Prof. Morgan from specimens received from Nebraska. Hollos considers this plant a synonym of *G. lageniformis* of which he sends specimens. (\*) It seems to me however that the plants while *very close* are different. *Lageniformis* has a protruding mouth. *Delicatus* the mouth is indefinite, plane, merely an aperture, the same as *G. hygrometricus*. We admit that the two plants are very close, probably the same, but for the present would keep them distinct. Had Morgan had access to Vittadini's figure we should not have blamed him for describing the plant he met as a new species. The figure is an

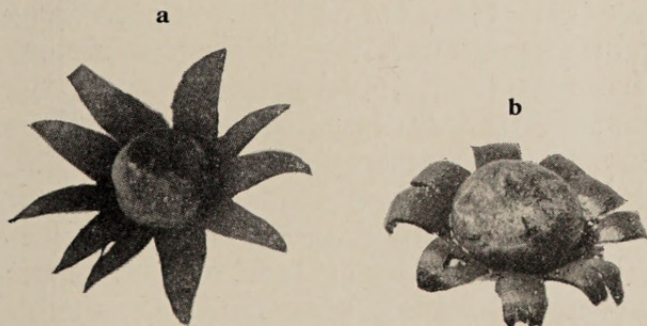


Fig. 14.  
*Geaster delicatus*.



Fig. 15.  
*Geaster delicatus* (unexpanded.)

(\*) See Appendix.



elongated, oval plant with a protruding mouth. *Delicatus* is a depressed globose plant with no protruding mouth.

From *G. mammosus* which this plant closely resembles in general, having the same thin hygroscopic peridium, it can be distinguished by its mouth. From small specimens of *G. hygrometricus* with which it agrees as to its mouth, it can be at once distinguished by its thin peridium and small spores.

#### Specimens in our Collection.

Washington, W. N. Suksdorf. Nebraska, Chas. E. Bessey, (given us by A. P. Morgan).

#### Explanation of Figures.

Fig. 14. *Geaster delicatus* expanded. Fig. 15. Same unexpanded.

a—Specimen from Chas. E. Bessey, Nebraska.

b—Specimen from W. N. Suksdorf, Washington.

### 3—GEASTER DRUMMONDII.

Exoperidium rigid, hygroscopic, strongly incurved when dry, cut (about  $\frac{2}{3}$  deep) to usually ten linear segments. Mycelium and fleshy layers absent in all specimens I have seen. Inner peridium globose, smooth, firm, sessile, having a short, conical, strongly sulcate mouth, not seated on a definite area. Columella linear (?) (\*). Capillitium simple, tapering, about thickness of spores in thickest part. Spores globose, rough, 5–7 mc.



Fig. 18. *Geaster Drummondii*.

The little plant is apparently rare. I first received it under the name *striatulus* from Dr. Hollos, Hungary. Afterwards I found it in Ellis' Exs. (No. 110) in Washington, Philadelphia and New York, labeled *mammosus*, (cfr. Myc. Notes, p. 71, No. 162, where however, the reference to Ellis' exsiccatae is given in error as 109). Hollos who is familiar with this small plant in Hungary, has examined specimens of *G. Drummondii* of Berkeley from Australia, and pronounced it the same plant, only larger specimens. We really see no essential difference in Cooke's description (save size) of the two plants in "Australian Fungi", and we believe Berkeley's illustration in Hooker's Journal is this plant. We think there is no question but that Kalchbrenner had the plant in view in his description of *striatulus*, (Grev. vol. 9, p. 3,) though he gives a wrong synonym. Henning beautifully illustrates the little plant from South Africa under the name *G. Schweinfurthii*, (Eng. Bot. Jahrb. Vol. 14, t. 6, f. 7.)

(\*) Very indistinct in specimens examined and not clearly made out.



### Geographical Distribution.

Hungary, (Hollos). Australia, (Kalchbrenner). South Africa, (Henning). New Jersey, (Ellis).

### Specimens in our Collection.

Hungary, Dr. Hollos.

Florida, Specimens from A. P. Morgan, (I am in some doubt as to these specimens, they are not so typically hygroscopic as all others I have seen.)

### Explanation of Figures.

Fig. 18. *Geaster Drummondii*. a—Expanded. b—Unexpanded. Specimens from Dr. L. Hollos, Hungary.

## 4—GEASTER MAMMOSUS.

Exoperidium thin, rigid, hygroscopic, smooth, divided almost to base into about ten linear segments, often umbilicate at the base as shown in fig. 17b. Inner peridium globose, smooth, sessile, furnished

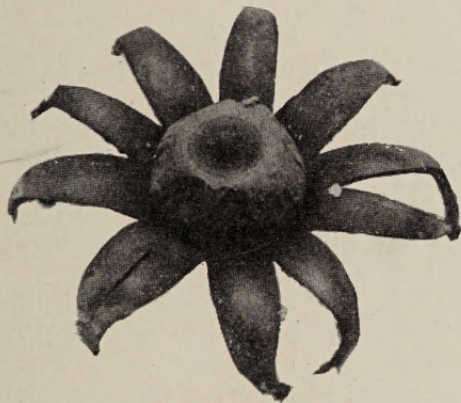


Fig. 16.

*Geaster mammosus*, (expanded.)

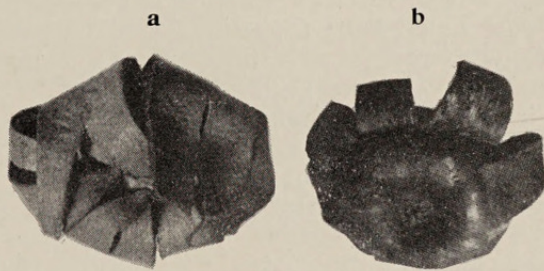


Fig. 17.

*Geaster mammosus* (unexpanded.)

with a conical, even, protruding mouth seated on a definite area. Columella short, globose, evident (though indistinct in mature plants). Capillitium simple, tapering, hyaline, often flattened, slightly thinner than the spores. Spores globose, roughened, 3–7 mc. (\*)

This plant differs from other hygroscopic species by its *even* conical mouth. The plant was early (1809) beautifully illustrated by Sowerby (t. 401). Fries (1829) gave the name *Geaster mammosus* to some plant, but not to this, as he describes it as drying with the exoperidium reflexed, and refers Sowerby's characteristic plate, doubtfully, to *Geaster hygrometricus*. Chevallier (1836) clearly describes and characterizes its difference from *hygrometricus* by its mouth. He is usually (and justly in our opinion) cited as the author of the name. Vittadini (1843) gave a fine figure of the plant, but strangely in his text states that it is the Friesian interpretation of the plant and "not Chevallier."

(\*) Morgan states 5–6 mc. We have specimens from Canada where the spores vary in the same plant from 3 to 7 mc. in diameter. Our English specimens run more uniform, 3 to 4 mc.



## Geographical Distribution.

This plant is distributed through Europe and United States. (\*)

## Specimens in our Collection.

Canada, Wm. Dearness. Minnesota, Minn. Bot. Survey. Iowa, W. J. Teeters. Pennsylvania, Dr. Wm. Herbst. California, L. E. Benton, (specimen from A. P. Morgan).

England, Chas. Crossland. Hungary, Dr. L. Hollos.

## Explanation of Figures.

Fig. 16. Geaster mammosus, expanded. Fig. 17. Same, unexpanded. Fig. 16 and 17b. Specimens from Chas. Crossland, England. Fig. 17a. From John Dearness, Canada.

## SECTION 2.—NON-RIGIDAE.

This section is readily recognized from the previous by the segments of the exoperidium not drying strongly incurved over the endoperidium. Two species which we include in this section (Smithii and arenarius) have a strong tendency toward the previous section, but the tips only of the exoperidium segments dry incurved, not the entire exoperidium. We divide the section into two subsections.

Mouths sulcate (see following)

Mouths even, (see page 22.)

### SPECIES WITH SULCATE MOUTHS.—NON-RIGIDAE.

Plants of this section are distinguished from the following section by the sulcate (not even) mouths. It is a question if the same plant under different conditions cannot have a mouth that varies, sulcate or even. If that is so then Geaster Morganii becomes G. lageniformis and Geaster arenarius becomes G. Smithii. We think while it is possible it is not proven, for our observation is that plants of the same collection have mouths either all sulcate, or all even.

Omitting from discussion at present G. Morganii (which differs in being truly sessile and usually saccate) and G. Smithii, (which is unique in itself,) there remains in this section G. pectinatus, G. Bryantii, G. Schmideli and G. asper. These four plants no doubt should be truly considered as forms of one species, but as they never run into each other so closely that there is trouble in naming them, we think it better to present them as distinct species. At the same time they have been so confused in literature it is almost a hopeless task to straighten out the tangled threads. All have strongly sulcate beaked mouths, all pedicels either short or long, all exoperidia usually revolute. All are covered partly in the text and partly in citations of Fries "striatus" and no doubt that conglomerate species of Fries is responsible for the confusion that has since existed.

## KEY TO THE SPECIES.

- Mouth long beaked, pedicel slender, inner peridium usually striate beneath,.....(5) pectinatus.  
Mouth long beaked; pedicel slender; inner peridium with a circular groove beneath,.....(6) Bryantii.  
Mouth short beaked; pedicel short, thick; peridium neither striated nor grooved,.....(7) Schmideli.  
Mouth short beaked; inner peridium short pedicellate, asperate (8) asper.  
Mouth conical, inner peridium sessile, .....(9) Morganii.  
Mouth flattened conical, depressed,.....(10) Smithii.

(\*) Notwithstanding Massee's statement "The North American specimens under this name are certainly not the true species."



## 5—GEASTER PECTINATUS.

Exoperidium revolute, cut about to the middle into 8 to 10 segments. Mycelial layer generally adnate, carrying with it soil. Fleshy layer thin, finally peeling off, and partly peeled off in most specimens giving them a ragged appearance. Pedicel slender. Inner peridium subglobose but somewhat tapering into the pedicel and marked with striae at the base, either faintly or strong enough to be called ridges. Mouth strongly sulcate, beaked, or slender conical. Capillitium slightly thicker than spores. Spores globose, rough, 5-6 mc. in diameter.

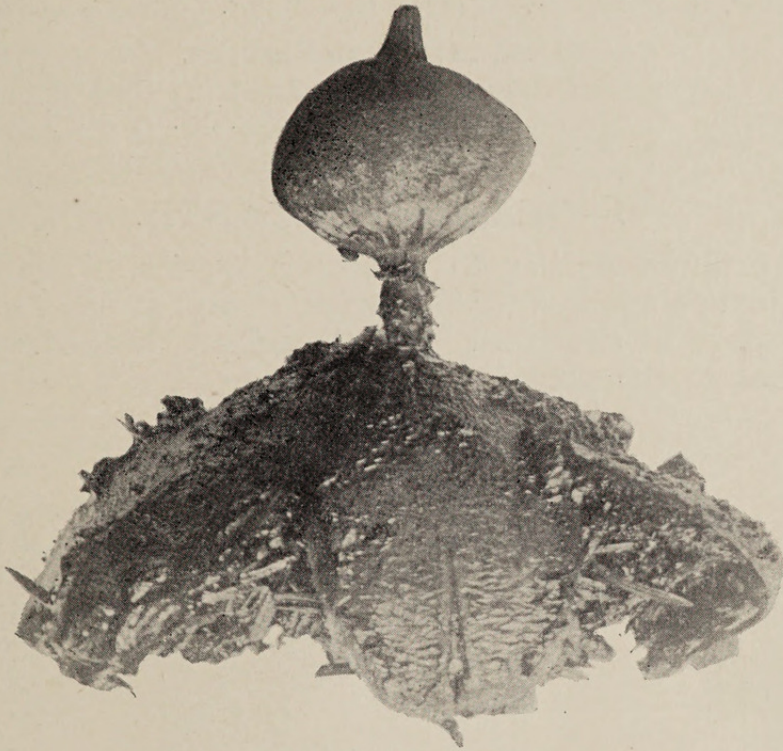


Fig. 19. *Geaster pectinatus* (large plant)

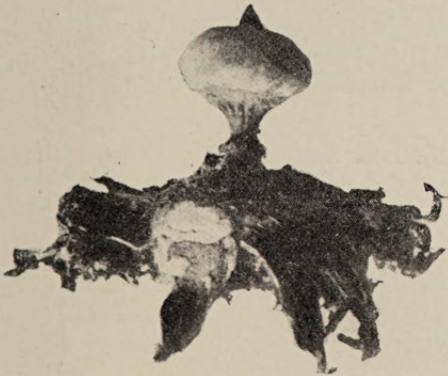


Fig. 20.  
*Geaster pectinatus*.

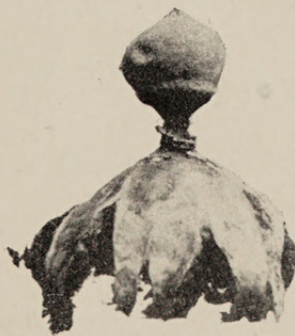


Fig. 21.  
*Geaster pectinatus*.



Fig. 22.  
*Geaster pectinatus* (small plant.)

Schmidel (1747) gave four figures (t. 37, f. 11-14) excellently illustrating this plant. Persoon (1801) called these figures *Geaster pectinatus*. Fries mixed it up with three other species under the name *G. striatus* and since Fries' day it has been so badly confused that we can only refer our readers to the references in appendix for details.



Hollos states that *G. pectinatus* is "a fungus of so rare occurrence it was quickly forgotten." It is undoubtedly a rare plant, we do not remember having seen a specimen in any of the Eastern collections, and yet we find we have five different gatherings, in our own collection. Miss Caroline A. Burgin of Philadelphia and Mrs. Delia Sams of Florida are the only collectors of the plant in this country to our knowledge.

#### Geographical Distribution.

Europe and the United States, rare in both countries.

#### Specimens in our Collection.

*Pennsylvania*, Miss Caroline A. Burgin. *Florida*, Mrs. Delia Sams.  
*Tirol*, Rev. G. Bresadola. *France*, E. Boudier. *Sweden*, L. Romell.

#### Explanation of Figures.

Fig. 19. Large plant from L. Romell, Sweden. Figs. 20 and 21. Specimens from Caroline A. Burgin, Pennsylvania. Fig. 22. A small plant, specimen from Mrs. Delia Sams, Florida.

### 6—GEASTER BRYANTII.

Exoperidium similar to preceding species. Pedicel slender. Inner peridium subglobose, or somewhat abrupt at base, marked with a circular groove at the base. Mouths sulcate, beaked. Capillitium and spores as in the preceding.

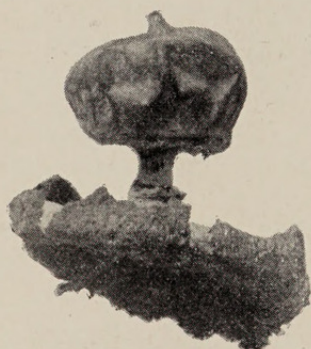


Fig. 23. *Geaster Bryantii*



Fig. 25. *Geaster Bryantii*.



Fig. 24. *Geaster Bryantii*.

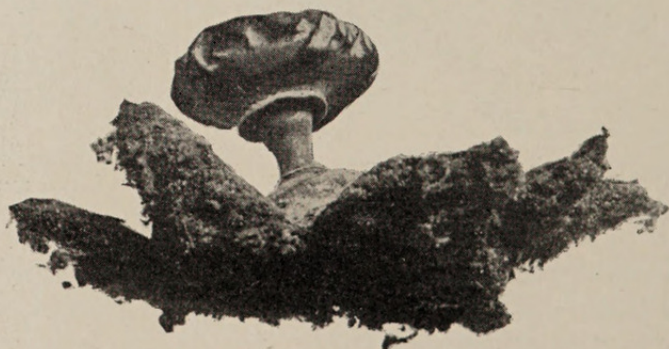


Fig. 26. *Geaster Bryantii*.



This plant is so close to the preceding that I am convinced it might more properly be considered a variety of it. Its distinctive feature the groove at base of peridium, is formed by the pedicel expanding to a disk shape top supporting the inner peridium, which being smaller where it is united forms a groove. It is the original of De Candolle's *Geaster striatus*, particularly as regarding his citations, but he does not mention in his text its distinctive feature, the circular groove. Hence there is a doubt whether he had this plant or the preceding. Fries, as previously stated, confused this plant with three others under the name *Geaster striatus*. Berkeley (Eng. Flo. p. 301) apparently drawing his conclusions from Fries, applied the name *G. striatus* to the preceding plant and renamed this *G. Bryantii*, citing the same references for it that De Candolle had cited for *striatus* with the addition of one citation, (Schmidel, t. 37, f. 11, 12). The last citation is an error, Berkeley having confused a ring shown on the pedicel of the cut, in reality a remnant of the fleshy layer, with the groove that this plant properly has. Berkeley's idea of a distinctive groove, the essential feature, is the first clear conception of the plant and we adopt his name, there never having been any confusion about it. The name *Geaster striatus* which priorists will no doubt use, is subject to the objection in our mind of not having been clearly defined in the first place, and having been applied since to *six different plants* by six different authors. Our specimens show another difference between this plant and *pectinatus*. The peridium is lead color, due to a kind of pruinose covering which may be rubbed off, and usually is on the exposed parts, giving the peridium a variegated appearance as shown in our photographs. (\*)

Misconception as to the value of the fleshy layer is the source of at least two species based on this plant. *Geaster orientalis* (Grev. vol. 6, pl. 98, f. 12) is the plant with fleshy layer still remaining and forming "a tube in the shape of a ring at the base of the interior peridium." *Geaster Kunzei* (Winter in Rabenhorst's Flora) is the same plant, the fleshy layer having peeled off, hence "Stiel ohne basale Scheide." I judge from literature that the species is more common than *pectinatus*, yet it has reached me more rarely and fewer specimens.

#### Specimens in our Collection.

*Maine*, H. C. Beardslee. *Texas*, W. H. Long, (specimen from C. L. Shear.)  
*England*, E. M. Holmes, Chas. Crossland. *Sweden*, L. Romell.

#### Explanation of Figures.

Specimens from: Fig. 23, H. C. Beardslee, (from Maine). Fig. 24, L. Romell, Sweden. Fig. 25, Chas. Crossland, England. Fig. 26, E. M. Holmes, England.

---

(\*) The student will note that this is exactly the reverse of statement made by Massee on same subject.



## 7—GEASTER SCHMIDELII.

Exoperidium revolute, cut to about the middle to usually five to seven segments. Mycelial layer usually adnate. Fleshy layer thin, usually adnate. Inner peridium with a short thick stipe or subsessile. Mouth conical, sulcate. Columella large, ovate. Spores small, globose, minutely roughened,  $3\frac{1}{2}$ –5 mc.

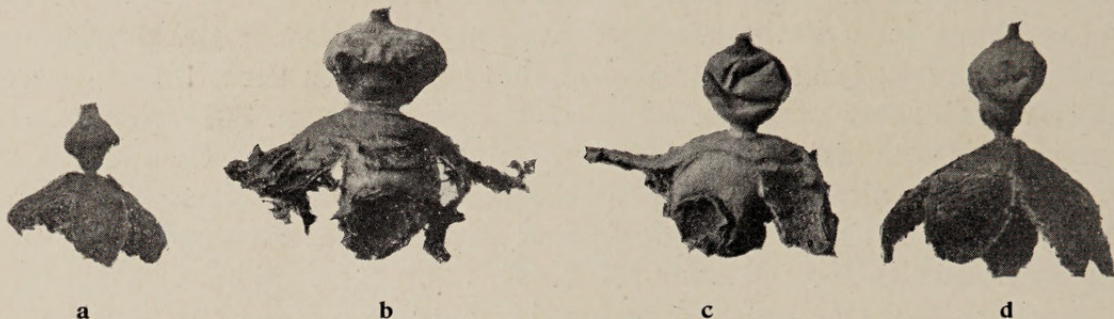


Fig. 27. *Geaster Schmidellii*.

This little plant is characterized by its small size, and short, thick pedicel. It is probably the plant covered in the text of Fries' *Geaster striatus*, but not his citations. It is the plant we think Chevallier intended to represent as *G. minimus*. (\*) We have adopted the name used in the first illustration (Vittadini) that represents accurately this plant, though a large one, and although Vittadini's citations cover other species. The plant seems to be rare and has reached me but rarely.

### Specimens in our Collection.

*Tirol*, Rev. G. Bresadola. *Hungary*, Dr. L. Hollos.  
*New Hampshire*, C. E. Montgomery. (We have seen specimens also from *Vermont* in collection of A. E. Burt, and from *New Jersey* (unlabeled) in collection of N. Y. Bot. Gardens.

### Explanation of Figures.

Specimens from : Fig. 27a, J. B. Ellis, New Jersey ; b and c, C. E. Montgomery, New Hampshire ; d, L. Hollos, Hungary.

## 8—GEASTER ASPER.

Exoperidium revolute, cut to about the middle to eight to ten segments. Both mycelial and fleshy layers are more closely adherent than in most species. Pedicel *short, thick*. Inner peridium subglobose, *verrucose*. Mouth conical, beaked, strongly sulcate, seated on a depressed zone. Columella prominent, persistent. Capillitium threads simple, long tapering. Spores globose, rough, 6 mc.

The character of this plant is the verrucose inner peridium. Under a glass of low power it appears as though the peridium was densely covered with grains of sharp sand. This plant alone has this character to our knowledge, and although it is indicated in the figures of *G. coronatus* of both Schaeffer and Schmidel, we think there it is an exaggeration of the very *minute* granular appearance *coronatus* has.

(\*) Hollos refers this figure to *Geaster asper*.



*Geaster asper* is on the plate of the first *Geasters* figured (Michelius, 1729, pl. 100, f. 2), where the plant is characteristically shown, excepting the pedicel is more slender than normal. The word

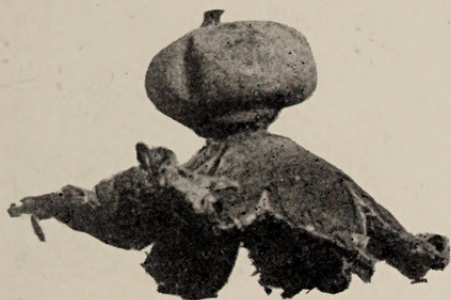


Fig. 28. *Geaster asper*.

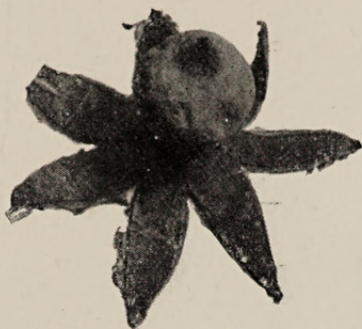


Fig. 29. *Geaster asper*.

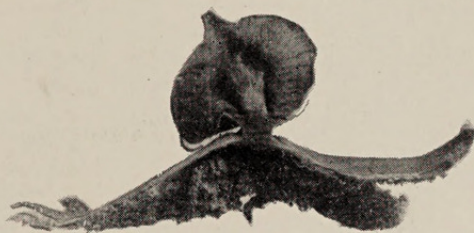


Fig. 30. *Geaster asper*.

“*asper*” is the first descriptive adjective applied by Michelius. Fries included it in his complex *striatus*. It has been described as a new species in recent times by three authors; as *G. campestris* by Morgan (1887); as *G. Berkeleyi* by Massee (1889); and as *G. pseudomammosus* by Henning in 1900.

#### Specimens in our Collection.

*Hungary*, Dr. L. Hollos.

*Kansas*, E. Bartholomew. *Kentucky*, C. G. Lloyd. *Ohio*, A. P. Morgan, (type specimens of *G. campestris*).

#### Explanation of Figures.

Figs. 28, 29 and 30 (section). Specimens all from A. P. Morgan, Ohio, and the type of “*G. campestris*.”

### 9—GEASTER MORGANII.

Young plant acute. Exoperidium cut beyond the middle to seven to nine *acute* segments. In herbarium specimens usually saccate but sometimes revolute. Mycelial layer closely adherent, compared to previous species relatively smooth. (\*) Fleshy layer when dry, thin closely adherent. Endoperidium globose, *sessile*. Mouth sulcate, indefinite. Columella globose-clavate. Capillitium thicker than the spores. Spores small, globose, 4 mc, almost smooth.

This plant is common around Cincinnati and was referred by Morgan to “*striatus*.” It is a reddish brown plant and differs widely from other species with sulcate mouths previously described in its

(\*) As in the previous species the mycelium covers the young plant but is not so strongly developed so that the adhering dirt is not so evident on the mature plant.



closely sessile endoperidium. It is the same plant as lageniformis, indeed Bresadola so refers it, excepting that plant normally has an even mouth, and no other species to our knowledge has mouths in both the



Fig. 31. Geaster Morganii.

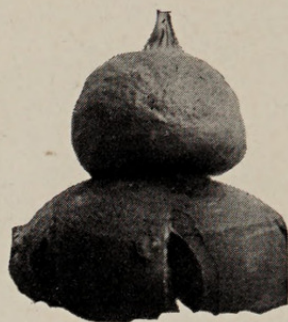


Fig. 32. Geaster Morganii.



Fig. 33. Geaster Morganii

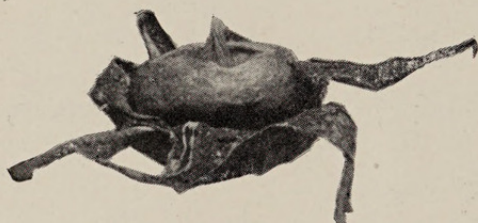


Fig. 34. Geaster Morganii.

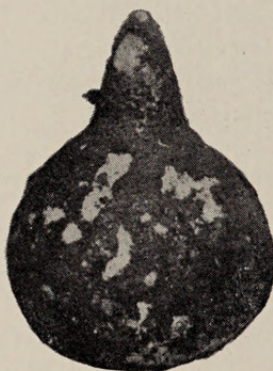


Fig. 35. Geaster Morganii.  
(A young plant.)

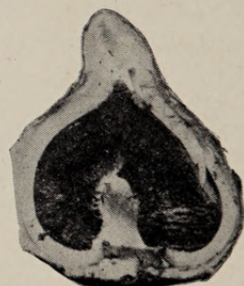


Fig. 36 Geaster Morganii.  
(Section of a young plant.)

even and the sulcate series. Still we are convinced of the strong probability of this view and have found in a collection of sulcate mouthed specimens *a single specimen with an even mouth*. It is quite common in this immediate vicinity growing about old stumps and logs, but has never reached me from any other locality in this country or from Europe.

#### Specimens in our Collection.

Ohio, Mr. Spurlock, W. H. Aiken, C. G. Lloyd.

#### Explanation of Figures.

Figs. 31, 32 and 33. Specimens from Mr. Spurlock. Figs. 34, 35 and 36. Collected by author; all from immediate vicinity of Cincinnati. Figs. 35 and 36 from fresh specimens, others from dried specimens.



## 10—GEASTER SMITHII.

Young plant globose. Exoperidium subhygroscopic, cut about half way to 8 to 12 segments, partly reflexed but tips of segments drying incurved. Mycelial layer thin, usually adnate, with adhering sand. Fleshy layer drying thin, adnate. Inner peridium subpedicellate, in reality almost sessile but the outer peridium drawing away from it. Mouth *flattened conical* (or when old conical) *seated on a depressed area, regularly sulcate-striate*. Color of spore mass blacker than in most Geasters. Threads about thickness of spores. Spores globose, rough, apiculate, 4-5 mc.

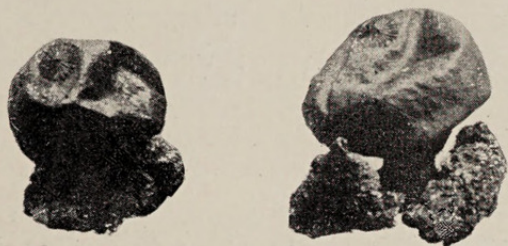


Fig. 37. Geaster Smithii.

This little plant is unique as to its mouth (well shown in our figures) from all other species. Morgan refers it to *G. umbilicatus* of Fries, and if we draw our conclusions only from what is published we should so refer it. Both Patouillard and Bresadola however, say "not umbilicatus" (\*) and they are in better position to know than we are.

This plant was well described and figured by W. G. Smith (in Gard. Chron. 1873, p. 469) under the erroneous name of *G. striatus*. The figures have the mouth more protruding than our cut, but that is a condition of age. His figures show the same *depressed* area characteristic of the plant. He states "the striae of the mouth are so matchlessly perfect and beautiful that no art can do them justice." We believe however, our figure will give a good idea of them.

Being unable to call this plant umbilicatus (as did Morgan) or striatus (as did Smith) we have named it in honor of Worthington G. Smith, who has done better work with Geasters of England than any other mycologist.

### Specimens in our Collection.

Florida, Mrs. Delia Sams.

### Explanation of Figures.

Fig. 37. Specimens from Mrs. Delia Sams, Florida.

---

(\*) "Not umbilicatus but a species unknown to me perhaps new."—Bresadola.

"Geaster umbilicatus of modern authors, but I am not certain that it is that species of Fries, and in any case it is *not* that of Montagne, neither of L  veill  "—Patouillard.



## SPECIES WITH EVEN MOUTHS.—NON-RIGIDAE.

(See remarks on page 14 under head of "Species with sulcate mouths.")

The even-mouthed species can be divided into three subsections:

Exoperidium recurved (not fornicate), (see following).

Exoperidium fornicate,\* (mostly quadrifid), (see p. 29).

Exoperidium saccate, sessile, (see p. 33).

### EXOPERIDIUM RECURVED, (not fornicate.)

#### NON-RIGIDAE, MOUTH EVEN.

The mycelial layer in this subsection is often disposed to separate either entirely or partly adherent (particularly in *limbatus* and *minimus*) but is never truly fornicate as in the following subsection.

#### KEY TO THE SPECIES.

Large species,

Unexpanded plant globose,

reddish brown, sessile or pedunculate,..... (11) *rufescens*.

black, pedunculate,..... (12) *limbatus*.

Unexpanded plant acute, plant reddish brown, ..... (13) *triplex*.

Small species,

pedicellate, not hygrosopic, ..... (14) *minimus*.

sessile, subhygrosopic,..... (15) *arenarius*.

## 11—GEASTER RUFESCENS

Unexpanded plant globose. Exoperidium recurved, cut to usually eight segments to about the middle. Mycelial layer, adnate with its adhering dirt or sometimes entirely peeled off. Fleishy layer mostly adnate, *thick*, porous, cracked and having the appearance of rough reddish leather. Inner peridium sessile or usually with a short thick pedicel, somewhat tapering toward the base. Mouth in-



Fig. 38. *Geaster rufescens*.



Fig. 39. *Geaster rufescens*.

(\*) The word fornicate meaning arched, as applied to a *Geaster* means *arched over the cup shape mycelial layer*.



definite, fibrillose, frequently torn. (\*) Columella large, thick, globose, permanent. Threads thicker than spores. Spores globose, roughened, varying from three to six mc.

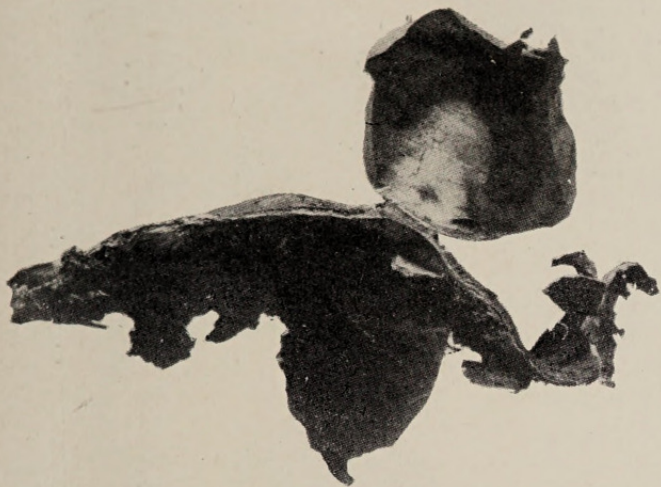


Fig. 40. *Geaster rufescens* (section).



Fig. 41. *Geaster rufescens* (unexpanded plant.)

This is the large reddish plant, the most frequent species we have in this country. It is sometimes sessile but usually has a short thick peduncle. The plant from the days of Persoon has been placed in the "sessile" section of the genus, hence when Morgan met the peduncled form he naturally referred it to *limbatus*. *Rufescens* is a reddish brown plant, *limbatus* is a black plant, otherwise they are very close, though *limbatus* has usually a longer peduncle and a different shaped inner peridium. Schaeffer's old figure of the plant shows a regularly toothed mouth and Fries no doubt basing his description largely on this figure, described it as having a toothed mouth. The mouth is often torn but no more frequently than any other species, and the idea that this species can be distinguished by its "dentate peristome" is entirely erroneous, and should be dropped from descriptions.

#### Specimens in our Collection.

*Ohio*, A. P. Morgan, (labeled *limbatus*), David L. James, Tom Bell, H. L. True, E. J. Arrick, Tom Lloyd, C. G. Lloyd. *New York*, Ida M. Hays. *Kentucky*, Sister Marie. *Canada*, John Dearness, (spec. tending toward *limbatus*.)

*Sweden*, L. Romell. *England*, Carleton Rea. *Hungary*, Dr. L. Hollos. *Tirol*, Rev. G. Bresadola.

#### Explanation of Figures.

Fig. 38. Specimens from A. P. Morgan, Ohio. Fig. 39. Specimens from David L. James, Ohio. Fig. 40. Section, showing large columella. Fig. 41. Unexpanded plant, specimen from Dr. H. L. True, Ohio.

### 12—GEASTER LIMBATUS.

Outer peridium recurved, cut to about the middle to eight to twelve segments. Mycelial layer usually adnate with its adhering dirt, often partially separate, and sometimes entirely peeled off. Fleshy layer drying firm, hard, and closely adnate. Inner peridium some-

(\*) Hence often inaccurately described as "toothed."





Fig. 42. *Geaster limbatus*

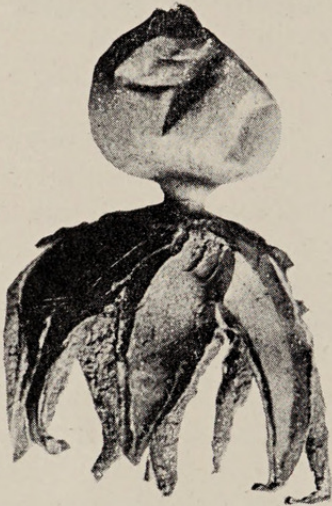


Fig. 43. *Geaster limbatus*.



Fig. 44. *Geaster limbatus*.



Fig. 45. *Geaster limbatus*.



times globose rounded at the base (Fig. 42) but usually "slightly constricted and then swollen at the base." (Fig. 45). Pedicel usually distinct—cylindrical (Fig. 43) but sometimes very short and thick, (Fig. 45). Mouth indefinite, fibrillose. Columella indistinct (in ripe specimens at least). Threads thicker than spores. Spores globose, roughened, 4–5 mc.

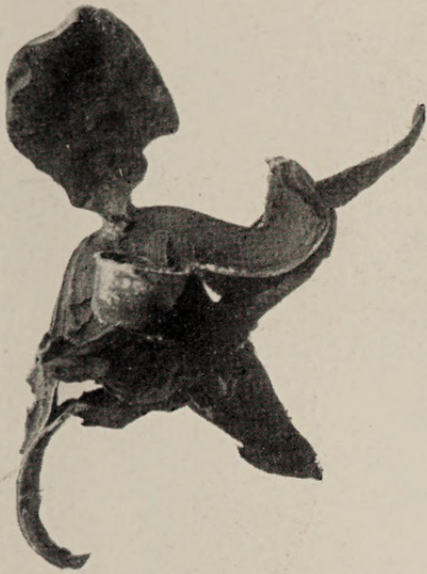


Fig. 46. *Geaster limbus* (section)

*Geaster limbus* is very close to *G. rufescens*, a fact that seems to have been noted by only one author, Scherffel. (\*) The writers who usually place *G. rufescens* in the "sessile" section do not realize that it is so close to *limbus* that specimens occur that are hard to refer to either species. *G. rufescens* is a reddish brown plant. *G. limbus* is a black plant but the color distinctions run into each other to an extent. We have never seen *G. limbus* with the thick porous fleshy layer, usually found on *rufescens*, and we have never seen *rufescens* with the peculiar constricted inner peridium usually (not always) found on *limbus*. We believe that the prominent, persistent columella of *rufescens* is the characteristic feature which distinguishes it from *G. limbus*. Any one knowing only extreme forms of *limbus* such as Fig. 42, from England, and Fig. 45, from Kansas, would be justified in calling them different plants, but our series of specimens shows all grades of connecting forms.

*G. limbus* is a frequent plant in this country and in Europe.

#### Specimens in our Collection.

Kansas, E. Bartholomew. Iowa, T. H. McBride. Wisconsin, Steve C. Stuntz.  
Massachusetts, F. Le Roy Sargent.  
England, Carleton Rea. Tirol, Rev. G. Bresadola. Hungary, Dr. L. Hollos.

#### Explanation of Figures.

Fig. 42. Specimen from Carleton Rea, England. Fig. 43. Specimen from Steve C. Stuntz, Wisconsin. Fig. 44. Specimen from Dr. L. Hollos, Hungary. Fig. 45. Specimen from E. Bartholomew, Kansas. Fig 46. Section showing indistinct columella.

### 13—GEASTER TRIPLEX.

Unexpanded plant acute. Exoperidium recurved (or when not fully expanded somewhat saccate at base), cut to the middle or usually two-thirds to five to eight segments. Mycelial layer adnate. Fleshy layer generally peeling off from the segments of the fibrillose layer but usually remaining partially free as a cup at base of inner peridium. Inner peridium subglobose, *closely sessile*. Mouth *definite*, fibrillose, broadly conical. Columella prominent, persistent, elongated (see Fig. 49). Threads thicker than spores. Spores globose, roughened, 3–6 mc.

(\*) "*Geaster limbus* steht dem *G. rufescens* ungemein nahe."



*Geaster triplex* is a reddish brown color the same as *G. rufescens* with which we think it has been much confused though in reality a very different plant. It is not recorded from England (to our knowledge) and we think English botanists have mistaken it for *rufescens*. As the early figures on which *rufescens* is based show neither of the characters by which that plant is distinguished from *triplex*, it is doubtful if the latter plant is not really the original *rufescens*. The two plants were confused evidently by all the early botanists. The character generally given to distinguish *triplex*, viz :—the remains of the fleshy layer forming a cup at base of inner peridium while usually present should be considered in the nature of an accidental feature and not an essential character of the plant. It is however, the feature from which the plant derives its name, viz :—*triplex*, three fold, three layers. The distinguishing features by which the plant can be known from *rufescens* are, the acute (not globose) young form, the definite mouth, and shape of the columella (see Figs 40 and 49.)



Fig. 47. *Geaster triplex*.

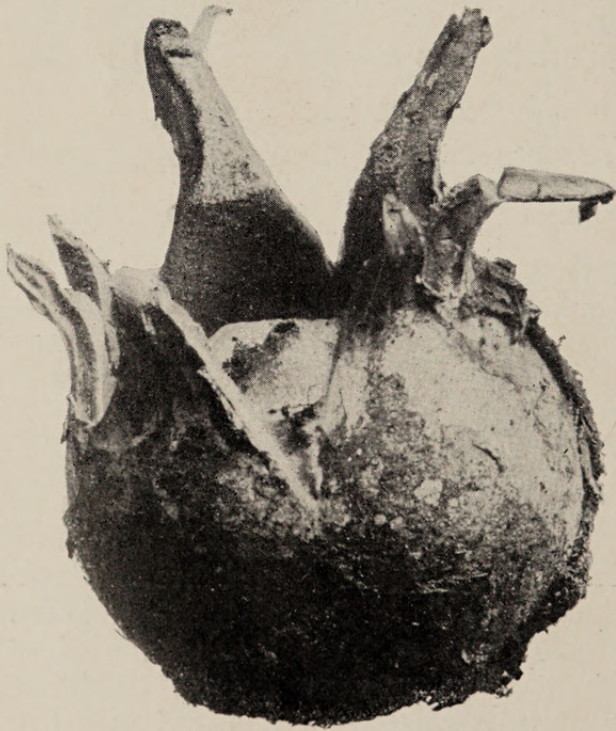


Fig. 48. *Geaster triplex*.  
(Beginning to expand.)

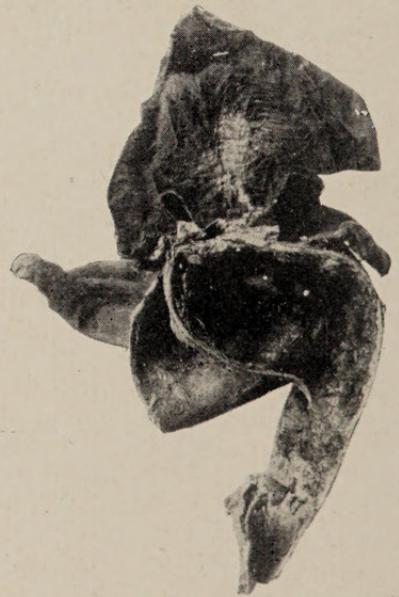


Fig. 49. *Geaster triplex*.  
(Section.)



*Geaster triplex* seems to be frequent both in this country and in Europe, though we have no specimens from Europe.

#### Specimens in our Collection.

Canada; J. Dearness. Minnesota, Minn. Bot. Survey. Ohio, A. P. Morgan. Pennsylvania, Caroline A. Burgin. Massachusetts, G. E. Morris. Connecticut, E. P. Ely.

#### Explanation of Figures.

Fig. 47. A typically expanded plant, showing the remains of the fleshy layer from which the plant received its name, specimen from A. P. Morgan, Ohio. Fig. 48. A fresh plant beginning to expand, specimen from E. P. Ely, Connecticut. Fig. 49. Section showing columella.

### 14—GEASTER MINIMUS.

Exoperidium recurved, cut to about the middle to eight to twelve segments. Mycelial layer usually adnate, usually shaggy with adhering fragments of leaves, etc., sometimes partly or entirely separating.

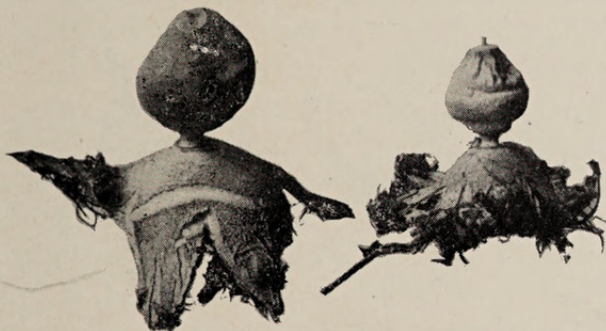


Fig. 50. *Geaster minimus*.

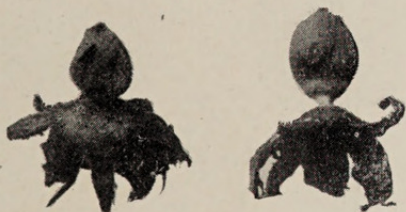


Fig. 51. *Geaster minimus*.

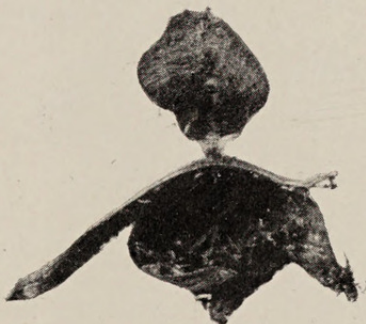


Fig. 52. *Geaster minimus* (section).

Fleshy layer closely adnate, very light color, usually smooth on the limb of the exoperidium but rimose on the segments. Pedicel short but distinct. Inner peridium subglobose or tapering to base, covered with minute granules, usually light colored, but sometimes almost black. Mouth definite, with well marked circular area. Columella slender. Threads slender, equal or thinner than the spores. Spores about 5 mc.

This little plant is the most common small species of *Geaster* we have in this country. It seems to be rarer in Europe where it is usually known as *G. marginatus*. Vittadini's cut accurately represents our plant and the identity of the European plant is well established. There is an earlier *G. minimus* of Chevallier but his figure is doubtful and even if it could be positively identified, it would not be advisable to replace the name so firmly established for the common American plant.

While the specimens in Schweinitz herbarium are normal, he described the plant as having a flattened base, "basi plano."



Morgan reconstructs a cut (Am. Nat. 1884, p. 967) based on this error.

#### Specimens in our Collection.

*Florida*, H. C. Culbertson, C. G. Lloyd. *Louisiana*, W. N. Clute. *North Carolina*, Hannah C. Anderson. *South Carolina*, P. H. Rolfs. *Ohio*, W. H. Aiken. *Pennsylvania*, Caroline A. Burgin, Dr. Wm. Herbst. *Michigan*, B. O. Longyear. *Iowa*, T. H. McBride. *Canada*, John Dearness.  
*France*, E. Boudier. *Tirol*, Rev. G. Bresadola.

#### Explanation of Figures.

Fig. 50. Specimens from W. H. Aiken, Ohio. Fig. 51. Specimens from Dr. Wm. Herbst, Pennsylvania. Fig. 51. Section.

### 15—GEASTER ARENARIUS.

Exoperidium subhygroscopic, cut to five to ten segments; drying usually with segments incurved. Mycelial layer closely adnate with adhering sand. (\*) Fleshy layer closely adnate, light color, not

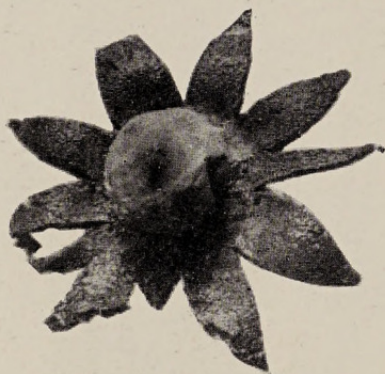


Fig. 53. *Geaster arenarius*.



Fig. 54. *Geaster arenarius*.

rimose. Inner peridium subglobose, with a very short but distinct pedicel in some specimens, in others appearing sessile. Mouth even, conical, acute, definite and usually darker colored than remainder of inner peridium. Columella indistinct. Spores globose, rough, 3-4 mc.

This little plant which I collected Feb. 1895, in the sand at Jupiter, Florida, I have never succeeded in getting named. My correspondents have suggested "*G. saccatus*" and "*G. floriformis*," but I am sure it is neither of these. It is very close to *minus*, differing in its shorter pedicel and more hygroscopic exoperidium. It is still closer to *Smithii*, excepting its mouth.

#### Specimens in our Collection.

*Florida*, H. C. Culbertson, C. G. Lloyd, (both from the sand at Jupiter, Florida.)

#### Explanation of Figures.

All specimens from Jupiter, Florida. The segments of the one closed are more strongly incurved than usual.

(\*) One specimen alone we have with the mycelial layer peeled away except at the tips, showing its relation to the fornicate section.



## EXOPERIDIUM FORNICATE.—NON-RIGIDAE, MOUTH EVEN.

The word fornicate means arched but as applied to a Geaster means *arched over the mycelial layer which separates and remains as a cup in the ground*. The first two species are thus strongly characterized, the third not to such a strong extent.

### KEY TO SPECIES.

- Mouth indeterminate, plant not rooting, ..... (16) fornicatus.  
Mouth indeterminate, plant strongly rooting, ..... (17) radicans.  
Mouth determinate, plant small, ..... (18) coronatus.

### 16—GEASTER FORNICATUS.

Outer peridium strongly and typically fornicate, the mycelial layer forming a perfect cup at base of plant. Fibrillose layer arched above the cup, to which it is attached by the tips of the segments, cut into four (rarely five) long segments. Fleshy layer partly adherent. Inner peridium distinctly urn shape as shown in our figures (not globose as Massee depicts) tapering below into a short thick peduncle. Mouth indefinite. Columella. (\*) Spores globose, almost smooth, 4 mc.

While the very early botanists (Persoon and Buxbaum) distinguished the plant from coronatus, as varieties of same plant, from the day when Fries made his confusing compilation (1829) up to last year, these two plants, so widely different (see figs. 56 and 61) that even the crude cuts are readily distinguished, have been confused by authors in general under the name "fornicatus." We have concluded to retain it (†) for this plant for two reasons. 1st, Hudson who first gave the name to a species of Geaster while confusing as to his citations, evidently knew only this plant, as evidence all tends to the fact that the other (coronatus) probably does *not occur in England*. Every English illustration, Bryant, Blackstone, Sowerby, Smith, Massee,) represents this plant. It is the only one we have received from England and English botanists advise us it is the only one they know. 2nd, The idea of a "fornicate" species is so strongly connected with the genus Geaster that it should be perpetuated in nomenclature, and applied to the plant that typically represents the idea. This plant which grows only in deciduous woods is much rarer in continental Europe than coronatus that grows common in pine woods, hence the latter plant is the usual species that has been distributed in exsiccatae under the name "fornicatus." These two plants are so distinct that it is strange to us how they could ever have been considered

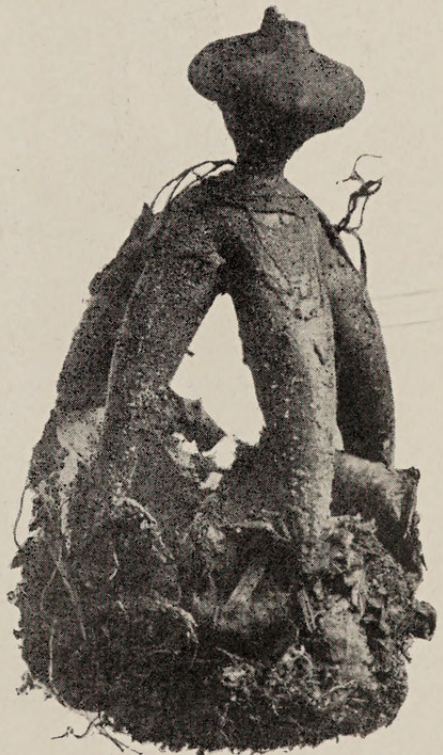


Fig. 55. Geaster fornicatus.

(\*) We do not wish to mutilate by cutting the few specimens we have of this plant.  
(†) This is a reversal of our decision last year (see Myc. Notes, p. 71).



varieties of the same plant much less confused under the same name. Fries not content by including in "fornicatus" two distinct species, further adds to the confusion by ascribing to it a sulcate mouth, a



Fig 56 *Geaster fornicatus*.

character which neither plant has. We do not think that *Geaster fornicatus* has ever been found in this country, and *Geaster coronatus* but rarely. The specimen preserved in the Schweinitz herbarium is neither of these species. (\*) We do not know what it is.

#### Specimens in our Collection.

*Hungary*, Dr. L. Hollos. *England*, Carleton Rea.

#### Explanation of Figures.

Fig. 55. Specimen from Dr. L. Hollos, Hungary.

Fig. 56. Specimen from Carleton Rea, England.

---

(\*) We state (*Myc Notes*, p, 77) that this is probably *radicans*, but a re-examination since of the specimen convinces us that it is not.



## 17—GEASTER RADICANS

Exoperidium typically fornicate, the outer layer separating and remaining as cup at the base, not having mycelium except at the base

where it is strongly developed in a cluster of root-like fibers. Fibrillose layer arched, cut to five (or usually four probably) segments. Fleshy layer thin, dark reddish, closely adherent. Inner peridium subglobose but tapering to the base. Mouth indefinite. Spores globose, almost smooth, 4 mc.

This plant related to *fornicatus*, is strongly different in the basal mycelium, and in the cup having lobes. It enjoys the unique distinction of being the only American species that has never been claimed by any one to grow in Europe. The only specimens we have seen are Rav. exsic. No. 103, and in the collection of Division of Veg. Pathology of Washington, where it was labeled "*fornicatus*." It grew on "a cedar log in Florida," but the collector's name not preserved. All its recorded stations are Southern and we believe it does not grow in our Northern States.



Fig. 57. *Geaster radicans*.

### Specimens in our Collection.

*Florida*, (Kindness of Mrs. Patterson from the Washington collection).

### Explanation of Figures.

Fig. 57. Specimen as above.

## 18—GEASTER CORONATUS.

Exoperidium fornicate, the mycelial layer forming an imperfect cup to which the arched segments of the fibrillose layer are loosely attached at the tips. The cup is not perfect however, as in the two previous species, but the mycelium is so strongly developed that adhering dirt and pine-needles represent an irregular mass rather than a definite cup. Segments of the arched fibrillose layer usually four, sometimes five, deeply cut, but relatively short as compared to the segments of *fornicatus*. Fleshy layer light colored, partially adherent or sometimes entirely peeled off. Inner peridium oblong, tapering to a short pedicel at the base and to an acute mouth at the apex, *covered with minute granular particles*. Mouth definite. Spores globose, roughened, 4 mc.



It is not necessary to repeat here what we have said under *for-  
nicatus* in regard to the confusion of these two plants. This plant is  
much closer to the *minimus* than to *fornicatus*. Indeed, its inner pe-



Fig. 58. *Geaster coronatus*.

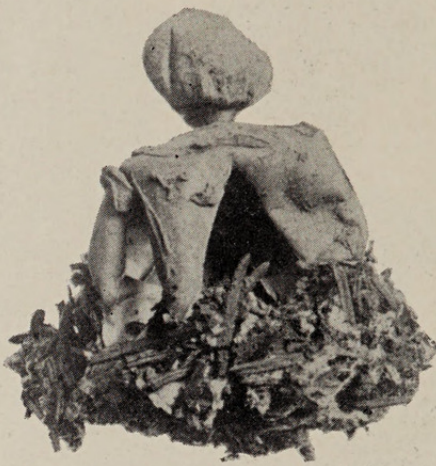


Fig. 59. *Geaster coronatus*.



Fig. 60. *Geaster coronatus*.

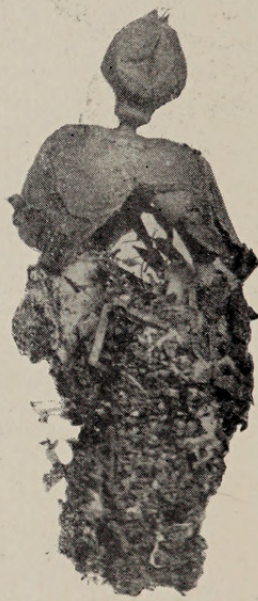


Fig. 61. *Geaster coronatus*.

ridium is the same as *minimus* and specimens, as often found in collec-  
tions devoid of the mycelial layer, might be referred to *minimus* if  
attention were not directed to its fewer and deeper lobes of the exope-  
ridium. There is really no name in use that we can apply to this plant  
free from all objections. Both *coronatus* used by Schaeffer and Sco-  
poli and *quadrifidus* by Persoon, include two plants in the citations.  
We have adopted the earlier name of Schaeffer because it is quite  
appropriate, (the plant is not inaptly compared to a crown) and there  
is no question as to Schaeffer's figure being intended to represent this  
plant. This species is very common in continental Europe and fre-



quent in collections (usually under the name *fornicatus*). Romell writes me that it is the most common Geaster of Sweden and hence must have been known to Fries, though why he describes the mouth as "sulcate" is strange if he had observed the plant instead of Schaeffer's inaccurate figure. We have never seen but one collection of the plant from this country made by G. E. Morris, of Waltham, Mass

**Specimens in our Collection.**

Tirol, Rev. G. Bresadola. Hungary, Dr. L. Hollos. France, F. Fautrey.  
Sweden, L. Romell.  
Massachusetts, G. E. Morris.

**Explanation of Figures.**

Fig. 58. Specimen from G. E. Morris, Massachusetts. Fig. 59. Specimen from F. Fautrey, France. Fig. 60. Specimen from Rev. G. Bresadola, Tirol. Fig. 61. Specimen from L. Romell, Sweden. The collar shown in this figure is an accidental remnant of the fleshy layer and might never occur in another specimen.

**EXOPERIDIUM SACCATE.—MOUTH EVEN.**

In all the previous species with even mouths the exoperidium when expanded is revolute away from the inner peridium, but in this subsection the base remains as a cup holding the inner peridium. We can readily conceive however, that this would not hold true in all cases, but it is the usual condition that we find in specimens. *Fimbriatus* of Europe while saccate in all our specimens is not put into the saccate section by Fries. *Lageniformis* while we have never seen specimens not saccate, we have of the closely related plant *Morganii* and conceive that if perfectly expanded this would become revolute (as Fig. 32). *Velutinus* and *saccatus* are however truly saccate species.

**KEY TO SPECIES.**

- Unexpanded plant globose,
  - Exoperidium splitting into two layers,
    - velutinate, ..... (19) *velutinus*.
    - smooth, .... (20) *fimbriatus*.
  - Exoperidium not separating, ..... (21) *saccatus*.
- Unexpanded plant acute, ..... (22) *lageniformis*.

**19—GEASTER VELUTINUS.**

Unexpanded plants globose, sometimes slightly pointed at apex. *Mycelium basal*. Outer layer rigid, membranaceous, firm, light color in the American plant; dark, almost black in the Samoan. Surface covered with short, dense, appressed velumen in the American plant so short that to the eye the surface appears simply dull and rough, but its nature is readily seen under a glass of low power. In the Samoan plant the velumen is longer and plant appears to the eye as densely tomentose. The outer layer separates from the inner as the plant expands and in mature specimens is usually partly free. The thickness and texture of the two layers is about the same. Fleshy layer dark reddish brown when dry, a thin adnate layer. Inner peridium sessile, dark colored, subglobose with a broad base and pointed mouth. Mouth even, marked with a definite circular light-colored basal zone. Columella elongated, clavate. Spores globose, almost smooth, small, 2½-3½ mc.



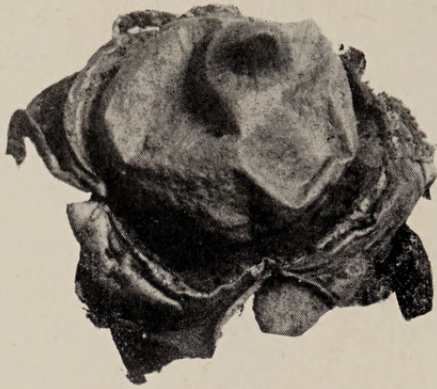


Fig. 62.

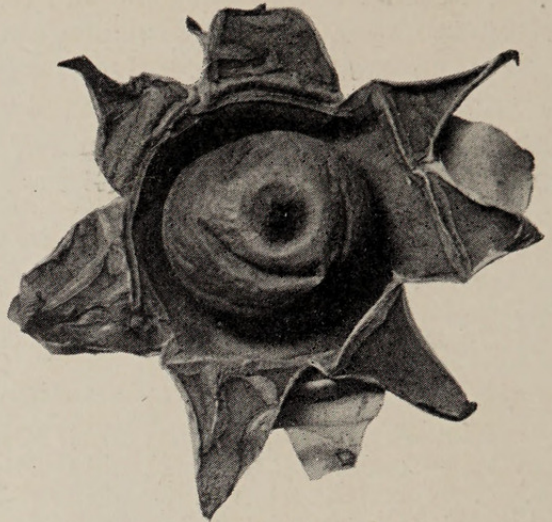


Fig. 63.

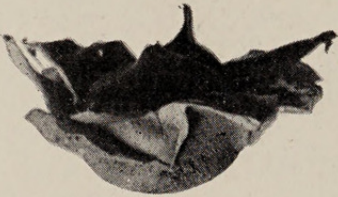


Fig. 64.



Fig. 65.



Fig. 69.



Fig. 71.

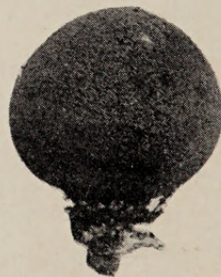


Fig. 68.

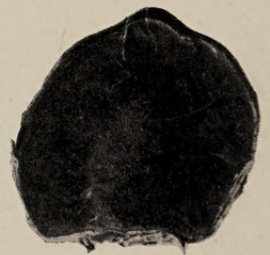


Fig. 70.

## GEASTER VELUTINUS.

### Explanation of Figures.

Figs. 62, 63 and 64. Expanded plant dried. Fig. 65. Just opening, showing the way two exoperidium layers separate. Figs. 66 and 67. Inner and outer view of a fresh expanded plant. Figs. 68, 69 and 71. Unexpanded plant. Fig. 70. Section of same.

Figs. 62, 63, 64 and 65. Specimens from Hugo Bilgram, Philadelphia. Figs. 66, 67 and 68. Photographs of fresh plants from Samoa. Figs. 69 and 70. From Cincinnati. Fig. 71. Specimen from A. P. Morgan and type of "*Cycloderma Ohiensis*."



This plant has a strange history. As far as we know it was first collected by Morgan in an unexpanded form and sent to Cooke,

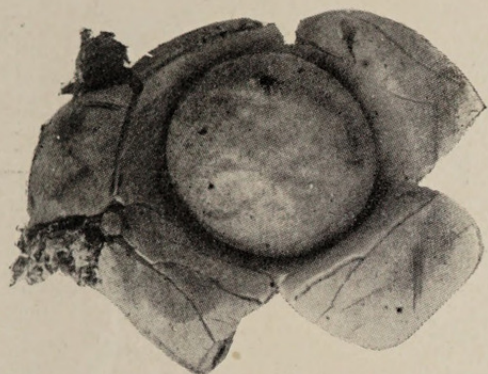


Fig. 66. *Geaster velutinus*.

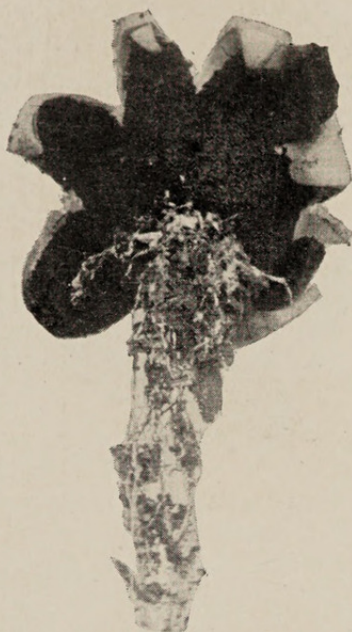


Fig. 67. *Geaster velutinus*.

who hailed it with delight as a re-discovery of the long-lost genus "Cycloderma" (see Grevillea 1882, p. 95) and named it *Cycloderma Ohiensis*. We have "type specimens" of this plant given us by Morgan. We first collected it in the same condition and determined and distributed it as above. In 1898 Hugo Bilgram of Philadelphia, sent us a fine lot of a *Geaster*, new to us but mixed with a number of unexpanded specimens that we recognized as "*Cycloderma Ohiensis*." Comparison with "type" specimen leaves no question. When Morgan found the *expanded* plant he did not recognize the "*Cycloderma Ohiensis*" he had sent Cooke, but described as a new species *Geaster velutinus*. During a trip I made to Samoa (winter of 1899) I gathered a *Geaster* and sent it to Bresadola, which was described in *Myc. Notes*, p. 50, as "*Geaster Lloydii*." The plant was very dark colored, almost black, and densely velutinate, and the mouth is not definite, but a comparison of the specimens now with our American, leaves no doubt in my mind as to their being the same species. We are glad we are not priorists and therefore do not have to adopt the name "*Geaster Ohiensis*" for this plant, although we might write "*Lloyd*" after it; for "*Ohiensis*" was based on a mistake in the first place and is a local name not fitting to a plant that grows in Samoa.

#### Specimens in our Collection.

*Canada*, Wm. Dearness. *Pennsylvania*, Hugo Bilgram. *North Carolina*, H. C. Beardslee. *Ohio*, C. G. Lloyd, A. P. Morgan, (Type of *Cycloderma Ohiensis*)  
*Samoa*, C. G. Lloyd, (Type of *Geaster Lloydii*).



## GEASTER VELUTINUS VAR. CAESPITOSUS.

A little plant growing densely caespitose, we collected and photographed at Crittenden, Ky. several years ago. We have lost our specimens but have no doubt it was but a small caespitose form of velutinus. The fresh plants were much darker color than the ordinary form, approximating in that respect the plants we collected in Samoa.

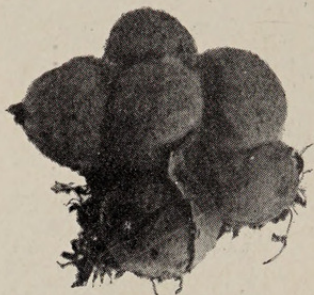


Fig. 72. *Geaster velutinus* var. *caespitosus*.  
(Unexpanded.)

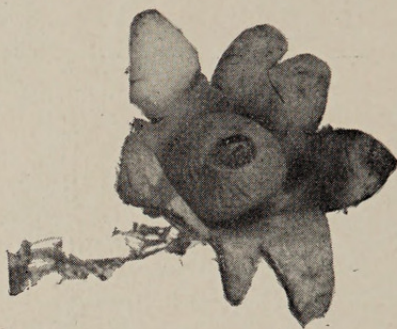


Fig. 73. *Geaster velutinus* var. *caespitosus*.  
(Expanded.)

### Explanation of Figures.

Figs. 72 and 73. From fresh plants, Kentucky.

## 20—GEASTER FIMBRIATUS.

Mycelium universal. Exoperidium cut to six to eight segments about half way, the limb shallow saccate. (\*) Outer layer membranaceous, usually separating partially from the inner, the two layers

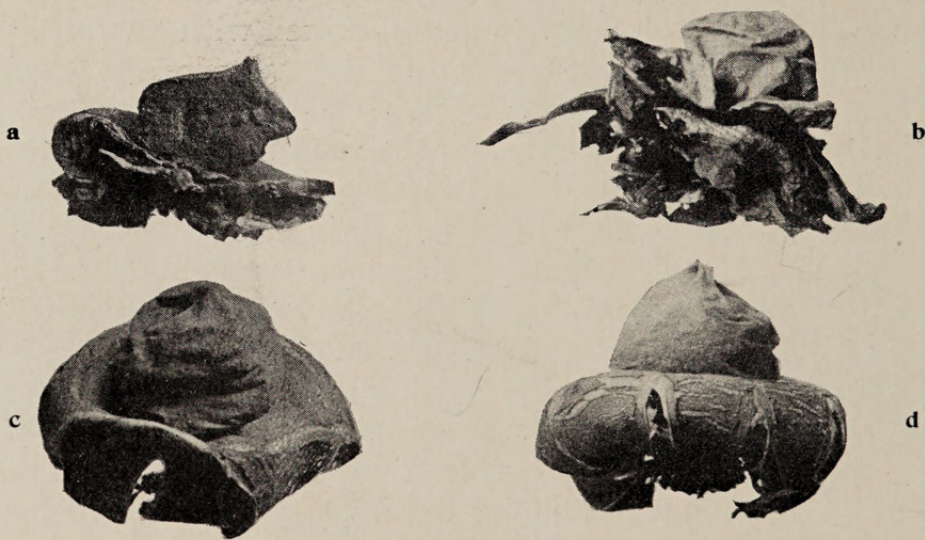


Fig. 74. *Geaster fimbriatus*.

being very similar as to texture and thickness as in the preceding plant. Flethy layer when dry, thin, adnate. Inner peridium sessile globose, with an indeterminate fibrillose mouth. Spores globose, almost smooth, 4 mc.

(\*) Fries who established the species did not describe it as saccate though if we can depend on the specimens we have, and the figure from Europe it belongs in this section.



This plant which I only know from European specimens I am convinced is practically the same plant as our *saccatus*. (\*) With the exception of the indeterminate mouth, and the tendency of the exoperidium to split into two layers I can see no other difference. The idea that *fimbriatus* can be known by its "fimbriate" mouth is an error. The mouth does not differ from several other species with indeterminate mouths. The plant is recorded several times from this country, but I think determinations are based on *saccatus*.

#### Specimens in our Collection.

*France*, E. Boudier. *Hungary*, Dr. L. Hollos. *Tirol*, Rev. G. Bresadola.

#### Explanation of Figures.

Fig. 74a, c and d. Specimens from Dr. L. Hollos, Hungary.

Fig. 75b. From Rev. G. Bresadola, Tirol.

### 21—GEASTER SACCATUS.

Unexpanded plant globose. Mycelium universal. Exoperidium cut to six to twelve segments about half way, the limb deeply saccate. Mycelial layer adnate to fibrillose. Fleshy layer when dry, thin, adnate. Inner peridium sessile, globose, with a determinate fibrillose mouth. Spores globose, almost smooth, 4 mc.

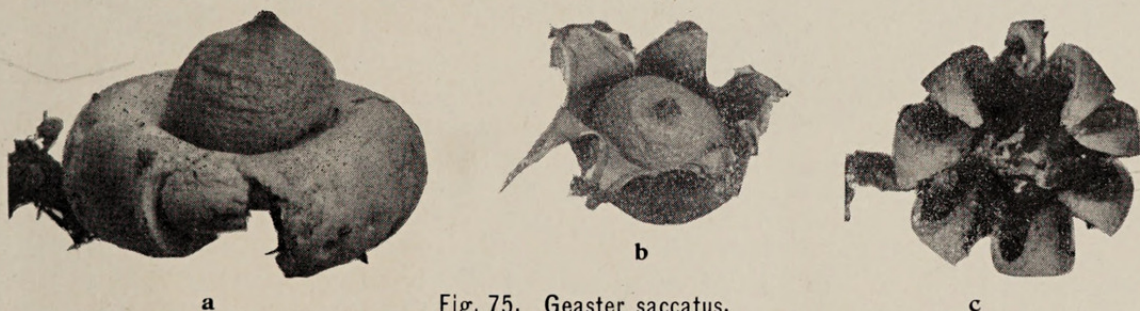


Fig. 75. *Geaster saccatus*.

Although the plant differs in being more deeply saccate and having a determinate mouth, I believe it is only the American expression of *G. fimbriatus* of Europe. It is a very common little plant in this section, growing gregarious over rich soil and decaying leaves in woods. *Geaster saccatus* is a name given to a South American plant by Fries and applied to our species by apparently universal consent. I do not know however, that anyone really knows that it is Fries' plant. It certainly is not the plant that Spegazzini distributed from South America as *saccatus*.

#### Specimens in our Collection.

*Florida*, Mrs. Delia Sams. *Missouri*, N. M. Glatfelter. *Minnesota*, Minn. Bot. Survey. *Illinois*, L. H. Watson. *Ohio*, A. D. Selby, W. H. Aiken. *Kentucky*, C. G. Lloyd. *Pennsylvania*, Ellen M. Dallas. *Mexico*, E. W. D. Holway.

#### Explanation of Figures.

Fig. 75a. Expanded plant from fresh specimens. Fig. 74b. From dried specimens. Fig. 75c. Reverse view of expanded specimen. All from collection of author.

(\*) Bresadola says not.



## 22—GEASTER LAGENIFORMIS.

Unexpanded plant acute, ovate, (compared to shape of a flask). Mycelium mostly basal. Exoperidium usually saccate. (\*) Mycelial layer generally closely adnate, sometimes disposed to separate, often split into parallel lines. (†) Fleshly layer thin, usually peeling off from the segments but remaining on the limb of the exoperidium. Endoperidium subglobose, closely sessile. Mouth conical, definite. (‡) Columella elongated, in dried ripe specimens somewhat subglobose. Spores globose, rough, 5–6 mc.



Fig. 76. *Geaster lageniformis*.



Fig. 77.  
*Geaster lageniformis*.  
(Unexpanded, dried.)

The entire plant is a reddish brown. Morgan (in conversation) suggests that it is a depauperate form of *G. triplex*, a view that is not improbable. The expanded plant can with difficulty be told from *G. saccatus*, though segments are more acute. The distinction is in the form of the unexpanded plant.

### Specimens in our Collection.

*Pennsylvania*, Dr. Herbst. *Florida*, Mrs. Delia Sams. *Connecticut*, E. P. Ely.  
*Minnesota*, Minn. Bot. Survey. *Washington*, W. N. Suksdorf.  
*Germany*, P. Magnus.

### Explanation of Figures.

Fig. 76. Expanded plant from dried specimens in N. Y. Bot. Garden.

Fig. 77. Unexpanded plant from Minn. Bot. Survey; the shape is no doubt more abruptly acute than the fresh plant would be.

---

(\*) In all our specimens and in Vittadini's figure. Smith (Gard. Chronicle 1873, p. 608) shows it recurved and it probably is so in fully expanded fresh plants.

(†) Mentioned by Morgan as *G. vittatus*.

(‡) In some specimens the entire mouth is lighter color than remainder of endoperidium, in other the mouth is dark but has a light color basal line.



## APPENDIX 1.

### REFERENCES.

These references are to plants and not to authorities for names of plants. They represent our views of the classification of *plants*. We do not present reference to the ownership or authority for names, as many authors do. Thus our citation under *Geaster asper* of "*Geaster granulatus* Cragin in Bull. Washburn" does not indicate that Cragin named a plant "*Geaster granulatus*." Whether he did, or did not, is of no possible interest to anyone save possibly to Mr. Cragin. The fact however, that he recorded a plant as "*Geaster granulatus*" which plant is *G. asper* is of interest to every student of *Geasters* and these facts alone we have endeavored to cite.

We give the names applied to plants since the adoption of the binomial system, and the fact that the *same name* has been applied to so many *different plants* by various authors we think should impress upon the student the importance of turning his attention to the study of plants, rather than the study of names. Previous to the adoption of the binomial system, we have cited no "names" as we consider the polyglot adjectives applied by the pre-Linnaean botanists in the nature of descriptions rather than names. We have given a few references on the authority of Rev. Bresadola (kindly communicated to us in letters), and some on the published work of Dr. Hollos.

Except when stated however, these references represent our views. We have cited very few references save where the plant is illustrated, or where we have seen specimens, for the citations of many authors are so conflicting that it is impossible to state what *plant* they have in view. Where an author gives an illustration of a plant that can be recognized, we accept that figure as representing the plant he had, though it may be in direct conflict to citations that he has made. We have given no bibliography in explanation of these references, and refer those interested to the excellent bibliography of the *Gastromycetes* given by Massee in Vol. 4 of *Annals of Botany*.

We feel and hope that most of our readers will study the plants that they meet, and that few will care to puzzle over these references. Those however, who study names of plants, or rather, who study misnames of plants, should be prepared to interpret these references without the aid of a "bibliography."

### MYRIOSTOMA COLIFORMIS.

Doody in Ray. Syn. 2nd Ed. App. p. 340,—*Lycoperdon coliforme*, Dickson Fasc. 1, t. 3, f. 4, (good); Sowerby t. 313 (fine); *Geastrum coliforme*, Pers. Syn. p. 131,—*Geaster coliformis*. Smith in Gard. Chron. 1873, p. 469, f. 86; (Reproduced Grev. Vol. 2, t. 15, fig. 1); Massee Monog. Brit. Gast. fig. 66; Fischer in Eng. & Prantl, p. 321, fig. A.

### GEASTER ASPER.

Michelius t. 100, f. 2 (more distinctly pedicellate but quite characteristic); Gleditsch Meth. t. 6, (copied from Michelius).—*Lycoperdon stellatum*. Purton Midland Flora Vol. 3, t. 20, (a splendid figure and rarely cited).—*Geaster asper*, Myc. Notes, No. 151; Hollos Term. Füzetek, (1902) p. 120; *Geaster Berkeleyi*, Massee Mon. Brit. Gast. t. 2, f. 41 (poor);—*Geaster campestris*. Morgan's Flora, p. 14; Ellis N. A. F. Exs. No. 1940; Hollos "Kül. a Term. Köz." p. 23, f. 9;—*Geaster granulatus*, Cragin Washburn Bull., p. 40;—*Geaster pseudomammosus*, Henning Hedw. Vol. 39, p. 54, (teste Hollos);—*Geaster pseudostratus*, Hollos Math. Term. Ert. (1901), p. 505, (Specimen examined, see Appendix p. 43).

### GEASTER BRYANTII.

*Geaster Bryantii*, Berk. Eng. Flo. p. 300; Mass. Mong. Brit. Gast. t. 4, f. 56; Smith Gard. Chron. 1873, p. 505, f. 94; Reproduced Grev. Vol. 2, t. 16, f. 2.—*Geastrum coronatum* var. *Woodwardii*, Pers. Syn. p. 132.—*Geaster calyculatus*, Fuckel Symbolae, t. 5, f. 3; Zopff & Sydow Exs. No. 6; Rabenhorst Exs. No. 2639.—*Geaster Bryantii* form *a fallax*, Scherff. Ber. Deut. Bot. Ges. 1896, t. 19, f. 3 (only);—*Geaster Rabenhorstii*, Haszl. Grev. Vol. 6, t. 98, f. 11.—*Geaster Kunzei*, Winter



Rab. Flora, p. 911.—*Geaster orientalis*, Haszl. Grev. Vol. 6, t. 98, f. 12.—*Geaster fornicatus* var. *multifidus*, Karsten (Spec. in N. Y. Bot. Garden).—Greville states "It is well figured in new series of Flora Londinensis." I have found no other references to this figure.

#### GEASTER CORONATUS.

Schmidel, t. 37, f. 1 and 2, (mouth not good in either, but both evidently this plant); Buxbaum, t. 28, f. 2, (teste Hollos); *Geaster quadrifidum* var. *minus*. Pers. Syn., p. 133;—*Lycoperdon coronatum*, Schaeffer, t. 183, (figure inaccurate but evident);—*Geaster fornicatus*, Thümen Myc. Univ. Exs. No. 526; Zopff & Sydow, Myc. Marc. Exs. No. 53; Kunze Exs. No. 11; Rabenhorst Exs. No. 2013b; Krieger Fungi Sax. Exs. No. 272; Roumeguere Exs. No. 3635; Winter's Rab. Flora, p. 896, f. 5; Hahn Pilzsammler, t. 29, f. 156; Myc. Notes, No. 153.—*Gastrum quadrifidum*, Pers. Comm., p. 75; Nees Pilze, t. 12, f. 128. (copied from Schmidel);—*Geaster quadrifidus* var. *minor*, Hollos Term. Füzetek, 1902, p. 116. (\*)

#### GEASTER DELICATUS.

*Geaster delicatus*, Morgan's Flora, p. 17; Ellis' N. A. F. Exs. 2nd Series, No. 1941.

#### GEASTER DRUMMONDII.

*Geaster Drummondii*, Berk. in Hooker's Journal, 1845, t. 1, f. 4.—*Geaster striatulus*, Kalch. Grev. Vol. 9, p. 3; Myc. Notes, No. 152.—*Geaster Schweinfurthii*, Eng. Bot. Jahrb. Vol. 14, t. 6, f. 7, (fine);—*Geaster mammosus*, Ellis N. A. F. Exs. No. 110.

#### GEASTER FIMBRIATUS.

*Geaster fimbriatus*, Fries' Syst., p. 16 (exc. cit.); Smith Gard. Chron., 1873, p. 543, f. 104; Reproduced Grev. Vol. 2, t. 17, f. 2; Roumeguere Exs. No. 510 and No. 2317; Thümen Myc. Univ. Exs. No. 411; Kunze Fung. Exs. No. 8; Desmazieres' Exs. No. 956; Rabenhorst's Exs. No. 2010b.

#### GEASTER FORNICATUS.

Battarrea Fung. t. 39, (characteristic): Buxbaum t. 28, f. 1 (teste Hollos). *Lycoperdon fornicatum*, Huds. Fl. Eng., p. 644; Sowerby t. 198, (fine, but segments of exoperidium not relatively long enough); Bryant f. 14-17 (teste Hollos).—*Geaster fornicatus*, Massee Mon. Brit. Gast. t. 2, f. 42, (subject to same criticism as Sowerby's figure); Smith Gard. Chron., 1873, p. 469, f. 87; Reproduced Grev. Vol. 2, t. 15, f. 2.—*Lycoperdon fenestratum*, Batsch Elen. t. 29, f. 168 a. b. (teste Hollos).—*Geaster fenestratus*, Myc. Notes, No. 150.—*Gastrum quadrifidum* var. *fenestratum*, Pers. Syn., p. 133.—*Geaster quadrifidus* var. *major*, Hollos Term. Füzetek (1902) p. 116. (\*)—*Geaster Marchicus*, Fischer in Eng. & Prantl, p. 321, fig. B.—*Pleostoma fornicatum*, Corda Icon. Vol. 5, t. 4, f. 43.—*Geaster MacOwani*, Kalch, in Grev. Vol. 10, p. 108.

#### GEASTER HYGROMETRICUS.

Schmidel t. 28; Michelius t. 100, f. 4, 5 and 6, (the last the best); Gleditsch Meth. t. 6, (copied from Michelius).—*Gastrum hygrometricum*, Pers. Syn. p. 135; Schweinitz Fung. Car. No. 329; Nees Pilze t. 12, f. 127, (copied from Schmidel).—*Geaster hygrometricus*, Fries Syst. p. 19; Smith Gard. Chron. 1873, p. 577, t. 112; Reproduced Grev. t. 13, f. 2; Trelease Trans. Wis. Acad. Vol. 7, t. 7, f. 1, (poor); Winter Rab. Flora, p. 895, f. 1-3;—*Geaster vulgaris*, Corda Icones, Vol. 5, t. 4, f. 42;—*Astraeus stellatus*, Fischer in Eng. & Prantl, p. 341, fig. A, B and C;—*Astraeus hygrometricus*, Morgan's Flora, p. 19;—*Gastrum fibrillosum*, Schweinitz Syn. Car. No. 330, (we have examined the specimen and it is unquestionably an old weather-worn specimen of *hygrometricus*).

(\*) The names adopted by Hollos seem very strange in view of the statement in the text "These two fungi are *no varieties* but are two different, independent species."



## GEASTER LAGENIFORMIS.

Boccone Mus. t. 301, f. 6; (section of young plant);—*Geaster lageniformis*, Vitt. Monog. Lyc. t. 1, f. 2; Myc. Notes, No. 167;—*Geaster saccatus*, Morgan's Flora, p. 18 (exc. of illustration); Smith, Gard. Chron. 1873, p. 1275, f. 266; Reproduced Grev. Vol. 2, t. 20, (We think the plant Smith took for lageniformis fig. 116, is a form of the plant but not so typically as the plant he called saccatus); Trelease Trans. Wis. Acad. Vol. 7, t. 7, f. 2.—*Geaster minutus*, Henning Hedw. Vol. 39, p. 54 (teste Hollos).

## GEASTER LIMBATUS.

Schmidel t. 46, (mouths too strongly defined); Ray Syn. 3rd Ed. t. 1, (poor);—*Lycoperdon stellatum*, Sowerby t. 312, (good); *Geaster limbatus*, Fries Syst. p. 15; Hussey Brit. Myc. t. 2, (splendid and shows both slender and thick peduncled forms); Zopff & Sydow Exs. No. 103; Myc. Notes, No. 154.—*Gastrum coronatum*, Pers. Syn. p. 132;—*Gastrum multifidum* var. *B*—"Pers. Disp. meth. p. 6"—*Geaster pseudolimbatus*, Hollos Math. Term. Ert. 1901, p. 507, (specimens examined, see Appendix p. 43).

## GEASTER MAMMOSUS.

Michelius t. 100, f. 3;—*Geaster mammosus*, Chevallier Flo. Paris, p. 359; Morgan's Flora, p. 16; Smith Gard. Chron. 1873, p. 543, f. 105; Reproduced Grev. Vol. 2, t. 19, f. 1; Vitt. Monog. Lyc. t. 1, f. 9, (fine);—*Lycoperdon recolligens*, Sowerby, t. 401, (fine).—*Geaster hygrometricus*, Masee, Monog. Brit. Gast. t. 4, f. 70, (His text of hygrometricus is correct but his figure is that of mammosus);—*Gastrum hygrometricum* var. *anglicum*, Pers. Syn. p. 135.

## GEASTER MINIMUS.

*Gastrum minimum*, Schweinitz Fung. Car. No. 327, (confirmed by examination of his specimen).—*Geaster minimus*, Fries' Syst. p. 16; Morgan's Flora, p. 15; Ravenel Car. Exs. No. 74; Ravenel Amer. Exs. No. 472; Ellis N. A. F. Exs. No. 109; Roumeguere Exs. No. 4549; Thümen Myc. Univ. Exs. No. 13; Myc. Notes, No. 146.—*Geaster marginatus*, Vitt. Monog. Lyc. t. 1, f. 6, (a small but correct figure of the plant);—*Geaster granulatus*, Fuckel (teste Bresadola), "I have just examined original specimens of *G. granulatus* Fuck. and it is *G. marginatus* 'tout à fait.'—"Bresadola.—*Geaster Schmidelii*, Roumeguere Exs. No. 3828.—*Geaster Queletii*, Hazsl. (teste Bresadola in letter.)—*Geaster Cesatii*, Rabenhorst (teste Bresadola in letter.)

## GEASTER MORGANII.

*Geaster Morganii*, Myc. Notes, No. 168.—*Geaster striatus*, Morgan's Flora, p. 17; Ellis' N. A. F. 2nd series, No. 2736.—*Geaster saccatus*, Morgan's Flora, Plate 1, f. C.

## GEASTER PECTINATUS.

Schmidel t. 37, figs. 11, 12, 13, 14, (the "rings" shown in fig. 11 has caused this figure to be referred, (erroneously) to *Bryantii*);—*Gastrum pectinatum*, Pers. Syn., p. 132;—*Gastrum multifidum* var. *a*, "Pers. Disp. Meth. p. 6."—*Geaster limbatus*, Smith Gard. Chron. 1873, p. 504, f. 95; Reproduced Grev. Vol. 2, t. 17, f. 1.—*Geaster Schmidelii*, Masee Mon. Brit. Gast. t. 4, f. 74; Winter Rab. Flora, p. 910;—*Geaster Bryantii* forma *fallax*, Scherffel Ber. Deut. Bot. Ges. 1896, t. 19, f. 1, 2 and 4, (not 3); *Geaster tenuipes*, Myc. Notes, No. 155.

## GEASTER RADICANS.

*Geaster radicans*, Ravenel Exs. No. 103; Myc. Notes, No. 159.

## GEASTER RUFESCENS.

Schmidel t. 43 (mycelial layer inaccurately shown; the "dentate" mouths of this figure are responsible for this erroneous idea in connection with the species). Schmidel t. 43 (cont. on t. 50).—*Gastrum rufescens*, "Pers. Disp. meth.



p. 6''; Pers. Comm. p. 74; Pers. Syst. p. 124; Schweinitz' Fung. Car. No. 328, (the specimen in his collection is typical but sessile).—*Geaster rufescens*, Fries' Syst. p. 18; Smith Gard. Chron. 1873, p. 577, f. 111, (Reproduced Grev. Vol. 2, t. 19, f. 2).—*Lycoperdon recolligens*, Sowerby t. 80, (Usually here referred but I think more probably fimbriatus).—*Lycoperdon stellatum*, Sowerby in index to same figure; Schaeffer t. 182, (mouth very poor).—*Lycoperdon sessile*, Sowerby in text under t. 401, (referring to fig. t. 80).—*Geaster multifidum*, Grev. Flo. t. 306, (the expanded plant has the fleshy layer gone and endoperidium distinctly peduncled, the unexpanded plant is globose).—*Geaster limbatus*, Morgan's Flora, p. 15, plate 1, f. B.; Ellis' N. A. F. Exs. No. 1309.—*Geaster mammosus*, Rabenhorst's Exs. No. 814.—*Geaster Schaefferi*, Vitt. Monog. Lyc. t. 1, f. 1, (a small plant).

#### GEASTER SACCATUS.

*Geaster saccatus*, Ellis & Ev. Fung. Col. Exs. No. 1217; Myc. Notes, No. 162.—*Geaster lageniformis*, Morgan's Flora, p. 19.—*Geaster capensis*, Thümen Myc. Univ. Exc. No. 715; Roumeguere Exs. No. 4548.

#### GEASTER SCHMIDELII.

*Geaster Schmidelii*, Vitt. Monog. Lyc. t. 1, f. 7.—*Geaster Rabenhorstii*, Trelease Trans. Wis. Acad. Vol 7, t. 7, f. 3; Kunze Exs No. 10; Rabenhorst Exs. No. 2011; Zopff & Sydow Exs. No. 7.—*Geaster striatus*, Peck's 38th Rep. p. 94, (teste Trelease).

#### GEASTER SMITHII.

*Geaster striatus*, Smith Gard. Chron. 1873, p. 469, f. 88. (Reproduced Grev. Vol. 2, t. 16, f. 1.)—*Geaster umbilicatus*, Morgan's Flora, p. 16, (exc. reference to Ellis' Exc).

#### GEASTER TRIPLEX.

Michelius t. 100, f. 1, (Fries refers this to fimbriatus, Smith to Michelianus).—*Geaster triplex*, Morgan's Flora, p. 18; Ellis N. A. F. Exs. No. 2735; Thümen Exs. No. 1410.—*Geaster cryptorhynchus*, Hazslinszky Grev. Vol. 3, p. 162, t. 47.—*Geaster Pelotii*, Rose (teste Bresadola).—"Geaster stellatus Linn." Morgan in Jour. of Mycology, Vol. 8, p. 4. (\*)

#### GEASTER VELUTINUS.

*Geaster velutinus*, Journ. Cin. Soc. Nat. Hist. Vol 18, p. 38; Cycloderma Ohiensis Grev. Vol. 11, p. 95.—*Geaster Lloydii*, Myc. Notes, No. 117.

(\*) Linnaeus' idea of "*Lycoperdon stellatum*" was simply the genus *Geaster* as we now know it. He did not know any *species* of Geasters and referred to "*Lycoperdon stellatum*" every figure of a *Geaster* he found, some half dozen different species. It is absurd in our mind to attempt to replace an established name of a species of *Geaster* on the *authority of Linnaeus*, a man who had no idea of *any species* of *Geaster*. Michelius who wrote many years before Linnaeus, had definite ideas of a few Geasters, but Linnaeus did not know enough of the subject to avail himself of the work of Michelius. Linnaeus apparently was not acquainted with the work of Schmidel, a pre-Linnaean botanist, who well illustrated several species.



## APPENDIX 2.

### SPECIMENS FROM DR. HOLLOS.

Since most of this pamphlet has been in type we have received from Dr. Hollos, Hungary, three specimens of Geasters.



Fig. 78.

Fig. 78, a little plant which Dr. Hollos sends as *G. floriformis* of Vittadini and considers same as *G. delicatus* of Morgan. We consider both of these views probable but neither proven. If it is *G. delicatus* then our idea of mouth of *G. delicatus* is wrong, for Hollos' specimen has a distinct and protruding mouth as shown in our figure, and we have always supposed *G. delicatus* to have a mouth not protruding, being merely an aperture. It is possible that these views, drawn from all specimens we have seen are wrong and that the mouth of *G. delicatus* *when perfect is protruding* as shown in fig. 78. In two of Hollos' specimens the mouths were worn off and the specimens could well be taken for *G. delicatus*. Let us hope that Messrs. Bessey, Piper, and Suksdorf who collect this plant will notice this point particularly during the present season.

As to the plants being *G. floriformis*, they do not agree with Vittadini's figure in two particulars. They are depressed globose; Vittadini shows an elongated plant. Their mycelium is evidently universal; Vittadini shows the mycelium *basal*, though this to our mind is probably erroneous as we *doubt if any of the rigidæ have basal mycelium*.



Fig. 79. *Geaster pseudostriatus*.



Fig. 80. *Geaster pseudolimbatus*.

Fig. 79 a plant that Dr. Hollos has recently described as a "new species," *G. pseudostriatus*. To our mind it is *G. asper* and differs but little from the form we have in this country. The longer peduncle, we consider only a condition, not an essential character.

Fig. 80 a plant that Dr. Hollos has recently described as *G. pseudolimbatus*. We should call it *G. limbatus*.



# .....INDEX.....

	PAGE
Myriostoma coliformis . . . . .	6
Geaster arenarius . . . . .	28
“ asper . . . . .	18
“ Bryantii . . . . .	16
“ coronatus . . . . .	31
“ delicatus . . . . .	11
“ Drummondii . . . . .	12
“ fimbriatus . . . . .	36
“ fornicatus . . . . .	29
“ hygrometricus . . . . .	8
“ lageniformis . . . . .	38
“ limbatus . . . . .	23
“ mammosus . . . . .	13
“ minimus . . . . .	27
“ Morganii . . . . .	19
“ pectinatus . . . . .	15
“ radicans . . . . .	31
“ rufescens . . . . .	22
“ saccatus . . . . .	37
“ Schmideli . . . . .	18
“ Smithii . . . . .	21
“ triplex . . . . .	25
“ velutinus . . . . .	33





Lloyd, C. G. 1902. "The Geastrae." *Mycological writings of C. G. Lloyd* 1, 1–43.

**View This Item Online:** <https://www.biodiversitylibrary.org/item/245896>

**Permalink:** <https://www.biodiversitylibrary.org/partpdf/328808>

**Holding Institution**

Harvard University Botany Libraries

**Sponsored by**

BHL-SIL-FEDLINK

**Copyright & Reuse**

Copyright Status: Public domain. The BHL considers that this work is no longer under copyright protection.

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.