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Astraeus and *Geastrum*¹

By MARION D. ERVIN

The genus *Astraeus*, based on *Geastrum hygrometricum* Pers., was included in the genus *Geaster* until Morgan⁹ pointed out several differences which seemed to justify placing the fungus in a distinct genus. Morgan pointed out first, that the basidium-bearing hyphae fill the cavities of the gleba as in *Scleroderma*; second, that the threads of the capillitium are long, much-branched, and interwoven, as in *Tulostoma*; third, that the elemental hyphae of the peridium are scarcely different from the threads of the capillitium and are continuous with them, in this respect, again, agreeing with *Tulostoma*; fourth, that there is an entire absence of any columella, and, in fact, the existence of a columella is precluded by the nature of the capillitium; fifth, that both threads and spore sizes differ greatly from those of geasters. For these reasons, Morgan stated that it is impossible accurately to define the genus *Geaster* and still place this fungus in it.

Fischer⁵ places *Astraeus* in the Calostomataceae with one other genus, *Calostoma*, on the basis of the layered fruiting body, the lack of a definite hymenium, and the lack of a columella. He separates *Astraeus* from *Calostoma* on the basis of the nature of the inner peridium, and the fact that *Astraeus*' outer peridium opens stellately, and is hygroscopic.

Although Coker and Couch², after having placed *Astraeus* in the Calostomataceae, recommended the establishment of a new family for the genus, G. W. Martin was the first to do this, giving the family the name *Astraeaceae*.⁸ Kambly and Lee⁶ adopted Martin's classification.

Cunningham³, disregarding all the differences of character pointed out by Morgan, retains the species in *Geastrum*, on the ground that the only feature of those outlined in which *Astraeus* differs from other geastrums is the primitive hymenium. He points out that the basidia are not arranged in the palisade-like layers of other species, but states that this difference disappears as maturity is approached, and that the fruiting body of *Astraeus* at maturity closely resembles that of any other member of *Geastrum*.

Zeller^{10 and 11}, on the ground that the gleba at maturity falls apart

¹Until recently, most writers have called the genus *Geaster*, following Micheli (1729), but since Persoon, in *Syn. Meth. Fung.* (1801) spelled the name *Geastrum*, that spelling is valid according to the International Rules.

into a powdery mass and that a well developed hymenium is lacking, places *Astraeus* in the order Sclerodermatales; on the further ground that the peridium is composed of a distinct exo- and endoperidium, and that the exoperidium splits into stellate lobes, places the fungus in the *Astraeaceae* as the sole genus.

Bessey¹ retains *Astraeus* in *Geastraceae*, although he realizes the differences pointed out in the glebal structure. His argument is that since the two types of gleba are present in the *Sphaerobolaceae*, the division of the family here is not necessary, and it appears best to retain *Astraeus* in the *Geastraceae*.

Observation shows *Astraeus hygrometricus* to possess a basidio-carp which superficially resembles *Geastrum*. The exoperidium consists of three layers, and splits stellately into 7 to 10 parts. The endoperidium has a definite mouth region, but there is no well defined mouth; this is also true of some geasters. It differs from *Geastrum* in that the basidia are not organized into a definite hymenium; the capillitium which is present, contrary to Zeller's opinion, is small in amount and the threads are continuous with the hyphae of the peridium. The capillitium is composed of slender dichotomously branched threads which measure 3 to 3.5 μ in diameter. The basidiocarp is sessile and hygroscopic; a subgleba and columella are lacking. The spores are globose, brown, pedicellate, warted, and measure 3.5 to 10 μ in diameter.

Although the exoperidium of *Astraeus* is composed of three layers as in *Geastrum*, and its stellate manner of dehiscence is also like *Geastrum*, the lack of a hymenium, the large pedicellate spores, the absence of a columella, and the presence of only a small amount of capillitium arising from the peridium should be sufficient to exclude *Astraeus* from *Geastrum*, and even from the Lycoperdales. These characteristics seem to suggest affinity with the Sclerodermatales, but the nature of the peridium should exclude it from the Sclerodermataceae; the absence of a distinct stalk should exclude it from the Calostomataceae or Tulostomataceae. There remains but one course to take; that is, to retain *Astraeus* in its own family, and to place the family *Astraeaceae* in the order Sclerodermatales.

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