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SCLERODERMA VULGARE AND ITS IOWA ALLIES.

GUY WEST WILSON.

The Sclerodermitaceæ, or so-called hard puffballs, have been very inadequately studied by American mycologists. Indeed it has been too common a custom to group all the material together as *Scleroderma vulgare* Hornem, without regard to external markings, the thickness of the periderm, or the mode of rupture for spore dispersal. Probably one of the most comprehensive treatments of the American forms is that by Lloyd¹ in connection with his studies on Australian species. His treatment has been followed with some variations by Hard² and by McIlvane³, each adding variations to the treatment of species. Several of the eastern forms have been figured by Murrill in *Mycologia*. However, no systematic account of the American forms has come to the notice of the writer.

As treated by Ed. Fischer⁴ the American members of the family fall under three genera, *Scleroderma*, *Pisolithus*, and *Sclerangium*. Of these the first and second rupture irregularly for the dispersal of the spores, while in the third the periderm breaks into stellate lobes as in *Geaster*. Usually the spore mass is exposed directly, but occasionally specimens are found with a very delicate and evanescent inner periderm. In *Scleroderma* the periderm varies in thickness in different species but it is always more permanent than in *Pisolithus*. The hymenial, (glebal) characters are also of considerable interest and subject to a wide range of variability. At first the hymenial surface is broken up into a series of closed chambers which are irregularly disposed among the sterile tissues of the sporophore. In *Scleroderma* these lose their individuality with the maturity of the sporophore, although they frequently remain as distinct lines of hyphae which gives the spore mass the appearance of being contained in numerous small pockets. In *Pisolithus* these chambers are persistent in the mature sporophore as peridioles quite similar in appear-

¹The Lycoperdonaceæ of Australia, New Zealand and neighboring islands, 1905, pp. 12-15, pl. 29-31.
²The Mushrooms, 1906, pp. 555-558, 567.
³One Thousand American Fungi, Revised edition, 1912, pp. 615-618.
⁴Engler & Prantl, Natürl. Pflanzenfam., 1899-1900, 1¹*: 334-338.

ance to those of the Nidularaceæ. This character is subject to a very wide range of variation so that in some cases it is necessary to rely entirely on the peridium to determine to which genus a given specimen should be referred.

KEY TO THE SPECIES.

- Distinct peridioles absent at maturity; periderm rather persistent.
 - Periderm rupturing irregularly.
 - Periderm thick.
 - Periderm conspicuously warty or scaly.....1. *Scleroderma aurantium*
 - Periderm smooth, or smoothish.....2. *Scleroderma Caepa*
 - Periderm thin.
 - Periderm rather firm and flexible, smooth or scaly.....3. *Scleroderma Bovista*
 - Periderm fragile above, warty.....4. *Scleroderma verrucosum*
 - Periderm rupturing stellately.
 - Spore-mass light colored.....5. *Sclerangium flavidum*
 - Spore-mass appearing almost black....6. *Sclerangium polyrhizon*
- Distinct peridioles present at maturity; periderm very fragile....
 -7. *Pisolithus arenarius*

I. SCLERODERMA Persoon.

Sporophore subglobose, with rhizomorphs and frequently rhizoids, or even a stalklike base; peridium single, usually thick, rather firm, opening irregularly; gleba homogeneous, capillitium none, the boundaries of the spore cavities remaining as more or less distinct lines of hyphæ; spores globose, roughened.

1. SCLERODERMA AURANTIUM (L.) Pers. (*S. vulgare* Hornem.)

Subglobose, sessile, radicate or not, 2.5—8 cm. in diameter; periderm thick, corky, usually pale with shades of yellow or orange, or sometimes brownish, usually covered with large warts which are more or less deciduous; gleba at first white, changing through various shades to blue-black and finally greenish gray; lines of trama yellowish; spores dark, globose, warted, 7—12 µ in diameter.

Johnson county (Macbride, Shimek, Miss Jewett), Linn county (Shimek), Muscatine county (Shimek).

The commonest species in our territory and one of the largest. It presents a considerable variation in the size and pattern of the warts on the periderm. The specific name is frequently incorrectly written "aurantiacum."

2. SCLERODERMA CAEPA Pers.

Subglobose or depressed, 3—8 cm. diam.; peridium smooth or only slightly roughened, never truly tuberculate, thick and firm; gleba at first white, finally ferruginous; trama lines light yellowish; spores dark, globose, tuberculate, 7—12 μ in diameter.

Johnson county (Shimek), Hesper, Winneshiek county (Shimek).

Very similar to *S. aurantium* but with a slightly thinner periderm which is essentially smooth or only slightly roughened.

3. S. BOVISTA Fries.

Sporophore subglobose, 3—5 cm. diameter, yellowish in color; periderm rather thin and firm, flexible, smooth or somewhat scaly; gleba at first white, at last brownish; lines of trama ochraceous; spores globose, verrucose, 7—12 μ diameter.

Johnson county (Macbride, Shimek), Muscatine county (Shimek).

A very distinct form which appears to be fairly common. It is easily distinguished by its firm, flexible periderm.

4. S. VERRUCOSUM (Bull.) Pers. (*S. tenerum* Berk.)

Sporophore subglobose, 2.5—7 cm. diameter, ochraceous, purplish, or dingy brown; periderm thin and fragile above, firmer beneath, covered with more or less angular warts, continued below into a more or less stemlike base; gleba white, then very dark vinous or almost black, at last umber; lines of trama white; spores globose, dark, warted, 7—12 μ in diameter.

Unionville, Appanoose county (Shimek), Hesper, Winneshiek county (Shimek), Mason City, Cerro Gordo county (Shimek).

A widespread and rather common species which might easily be passed over as immature specimens as it ranges quite small in our territory. The thin, fragile periderm distinguishes it readily from *S. aurantium*. The white trama lines also are quite distinctive. Probably second only to *S. aurantium* in commonness.

II. SCLERANGIUM Leville.

Similar to *Scleroderma* except that the periderm ruptures stellately, sometimes exposing a thin inner periderm.

5. *S. FLAVIDUM* (Ellis & Everh.) nom. nov. (*Scleroderma flavidum* Ellis & Everh.)

Sporophore depressed-globose, yellowish; periderm thick and firm, scaly, especially above, splitting stellately into three to eight triangular lobes; spore-mass at maturity umbraceous, or shading towards brown; lines of the trama light ochraceous; spores globose, roughened, 7—13 μ in diameter.

Johnson county (Wilson).

Differs from *Scleroderma aurantium* in its mode of rupture and from *Sclerangium polyrhizon* in its smaller size, its lighter color and the lighter colored spore mass.

6. *S. POLYRHIZON* (Gmel.) Lev. (*Scleroderma Geaster* Fries.)

Sporophore rather large, globose, 3-7 cm. in diameter, yellowish brown to greenish brown; periderm thick, smooth, splitting stellately into three to six teeth; inner periderm if present very thin and fragile; spore mass very dark, appearing almost black; lines of trama whitish; spores globose, dark, coarsely warted, 12—16 μ in diameter.

Johnson county (Macbride).

A very distinct and striking species which upon rupture bears a superficial resemblance to an earth star (*Geaster*).

III. *PISOLITHUS* Alb & Schw. (*Polysaccum* DC.)

Resembling *Scleroderma*, but with a thin and fragile periderm, and persistent peridioles.

7. *P. ARENARIUS* Alb. & Schw. (*Polysaccum Pistiscarpum* Fries.)

Sporophore depressed-globose, with a pronounced rootlike base; periderm smooth, dark brown, fragile and soon breaking irregularly; gleba white, becoming brown; peridioles polygonal or ellipsoidal, golden brown or red-brown, spores brown, verrucose with blunted warts.

This species could easily be passed over in the field as a *Scleroderma*, but even a superficial examination shows its marked points of separation from that genus. This is a very rare species in America and is included here provisionally on the basis of a specimen in the University herbarium bearing the locality data "Hesper? S?" which indicates that it was probably collected at that locality in Winneshiek county by Professor Shimek. Its further collection is to be looked for with considerable interest.