

spores in each smut ball. To comprehend the size of the spores and enable one to realize the extreme danger of sound grain becoming infected, a photograph has been taken of smut spores among which a human hair has been placed for comparison. This photograph shows the spores, as well as the hair, much enlarged, but both to the same extent, and we can now measure for ourselves that eight smut spores may be placed side by side in order to stretch across a hair (plate 1, fig. a). Once this minuteness of the single spore is comprehended, it will not be difficult to realize the extreme caution necessary to prevent them from flying about and settling upon all sorts of farm machinery, implements, tools, manure heaps, etc., from which they will be ultimately conveyed to the soil, in addition to the danger of direct infection of the soil which may take place under the conditions already discussed in the introductory chapters. Each individual spore is capable of spreading the disease.

We have already compared the fungus spore to the 'seed' of plants. Just as the seed or kernel of wheat is the agent reproducing the wheat plant, so is the fungus spore the 'seed' of the smut disease.

The spores of the stinking smut fungus are minute, round, brownish bodies with a reticulated surface—that is with fine net-like markings.

*Longevity of spores.*—The longevity of the stinking smut spores has been repeatedly investigated. The loose spores may retain their life for at least three years, but in the case of the unbroken smut balls, the spores within are known to have germinated some seven to eight years after production. Wheat that has been kept for eight years under suitable conditions of storage, and which at first germinated 99 per cent, showed only a germination of some 47 per cent. This makes it practically useless to store infected wheat in the hope of securing freedom from smut. The longevity of stinking smut spores is of importance to the fungus itself as it is a natural adaptation to the conditions under which the fungus plant has to live. Should the spore retain its life for a short time only—as is the case with the true loose smuts—then the possibility of reproduction would be very limited and that is contrary to nature. The purpose of the seed or the spore is to reproduce its kind, hence plants depending entirely upon this mode of reproduction have generally long-lived seeds.

*The germination of the spore.*—When wheat is sown which is infected with smut spores, either naturally or owing to lack of care, the spores pass through various stages of development before the wheat plant becomes infected. At first, the smut spore bursts open at any point, and a short, stout germinal tube is pushed out (plate 8, fig. B, '1'). This is known as the promycelium. The next stage is the production of a series of sickle-shaped pairs of secondary conidia arranged in a circle around the apex of the short tube (plate 8, fig. B, '2'). Each member of this 'wreath' of spores may produce another stouter, but shorter spore (plate 8, fig. B, 3), or directly, a fine hair-like tube, or the new spores may produce such tubes. These hair-like tubes of mycelium are the infection tubes. When these tubes are formed, during the period of the germination of the wheat, from the moment of the production of the first rootlet up to the time the first leaf is ready to push through its protective sheath, an infection is almost sure to follow. The infection tube pierces the young and tender tissues of the wheat seedling, and when successful in reaching the growing point, it continues to grow as the wheat grows, unnoticeable externally, until spore production, which takes place in the wheat ear.

It has been previously stated that the conditions of temperature prevailing at the time of the germination of wheat and spore may determine whether an attack will result or not. In this connection it may be mentioned that occasionally there may be found only one or more ears attacked by the fungus, while others of the same plant may be quite sound. This fact may be explained as follows:—

Each ear of wheat is produced in a separate shoot with a definite and individual growing point. Generally speaking, the fungus attacks the various growing points at an early age, but when, for some reason or other, the first ears have