

*Analogy of smut spores and pollen grains.*—Pollen grains which do not reach the style but fall to the earth or elsewhere soon succumb, because their only function is the fertilization of the ovule. The smut spore likewise succumbs very quickly if it does not reach the style of the wheat flower. Having been successful in reaching that spot necessary for its perpetuation, it germinates in a manner similar to but not necessarily identical with, that of a pollen grain, pushing its germinal tube first through the fine hairs of the feathery style (plate 3, fig. 8), then through the style itself, and finally, into the ovule, where its progress is arrested for the time being. Its germination is only by means of the germ tubes which it sends into the forming seed, causing a direct infection of the young grain. There is no need for secondary spores, nor any necessity for a prolonged life in the spore stage, inasmuch as the fungus lies well protected within the grain. To perpetuate its kind, the spore must reach the flower of the wheat. If the period of flowering is over the smut spore must die.

*Smut fungus lives in the grain.*—During the development of the grain the smut fungus now within it makes but little growth, but remains alive, though quite dormant like the seed itself. The filaments or mycelium of the fungus were first successfully demonstrated by Hecke in the tissues of the young plant. Later in 1910 Wilhelm Lang provided convincing evidence of the presence of the germ within the grain (plate 3, fig. 9). Every infected grain will give rise to an infected wheat plant, the ears of which will contain a new crop of spores, and thus a new life cycle will begin.

*Loose smut cannot be controlled by formalin or bluestone.*—From the above description of the life history, it will be readily understood that this smut cannot be controlled in the manner prescribed for stinking smut. Though there may be hundreds of thousands of spores present on the surface of the wheat grains or in the soil, we know that they are dead, or at any rate need not be taken into consideration as carriers of infection. We also know that the germ of the disease lurks within the embryo of the grain, without revealing its presence by any external symptom. Even the recognition of the germ within the embryo is a matter of difficult technique. But all the same the disease is present and will appear, with hardly any exception, in the plant growing from such seed.

*Remove whole plant if affected.*—However often a farmer may pull out diseased ears as they appear, every new shoot will produce new smutted heads, hence the whole plant should be destroyed immediately the disease becomes noticeable. It will also be realized that the prevention of this kind of smut must be, if at all possible, along very different lines from that of stinking smut.

*Successful treatment regarded with doubt.*—The opinion expressed by Brefeld that, owing to the presence of the smut fungus in the grain, it would not be possible to kill the smut fungus without destroying the germination of the wheat itself, was shared by a large number of other investigators.

*Discovery of hot water treatment.*—However, when the question regarding the control of smut diseases had received the attention of a large number of investigators, who, at that early date, were still in the dark about the life history of the loose smuts, one of them, Mr. J. L. Jensen, of Denmark, discovered in 1887 that hot water of certain temperatures would destroy the life of smut spores, especially of those diseases propagated by spores adhering to the surface of grain, without injuring to any marked extent the germination of the grain itself. At first, the method was employed simply against stinking smut of wheat, oat smut, and others of the same kind. But the method was ultimately improved, when it was found that by carefully treating grain which contained the loose smut germ within its tissues, control of the disease was obtained, and, at the present stage of our knowledge, it would seem the only one efficient in checking the recurrence of loose smuts.