

Covered Smut of Barley

Pathogen: *Ustilago hordei*

Systematic Position: Sub. Division- Basidiomycotina, Class- Teliomycetes, Order- Ustilaginales, Family- Ustilaginaceae

Distribution & Importance: The covered smut of barley is worldwide in its distribution. It is found all those countries where the barley crop is grown. It is a common disease of barley in northern India. It causes considerable damage in the Punjab, Uttar Pradesh, Madhya Pradesh and certain parts of Bihar. In severe cases of infection the yield may be lowered by 50 per cent of the crop.

Symptoms: Infected plants appear normal until heading. Smutted heads emerge at the same time or slightly later than healthy ones. In some cases they may be "trapped" by the flag leaf sheath. Infected heads are readily visible in the field. The smutted or blackened ears come out of the leaf sheath, which may easily be recognized from long distance. All the ears of diseased plant become infected and all the developing grains turn into smut sorus remains covered by a white, shining, silvery membrane, which is partially developed from host tissue and partially from fungus. Due to this compact covering, the smut spores are not blown off, and thus the disease is named "covered smut". The membrane remains intact until harvest.

Pathogen: The mycelium is internal and dikaryotic. The hyphae are septate and branched. They ramify in the intercellular spaces between the cells in the host tissue. The mycelium grows in the stem as well as in the leaves but generally it is confined to the stem. By the flowering time it reaches the ear where it grows more vigorously. The fungal hyphae enter the ovaries of the flowers. There they branch repeatedly and become additionally septate. The short, binucleate segments thus formed round off to form the binucleate smut spores. The latter remain compacted together into a ball-like mass in each ovary. They are liberated at the threshing time by the breaking of the walls of the ovary. The spores thus set free remain attached to the surface of the healthy grains. The spores are light brown in colour and globose to ellipsoidal in shape with smooth wall. In a mass they appear black. Each measures 9μ in diameter.

Disease Cycle: This is an externally seed borne and systemic disease and perennates through the smut spores which adhere to the healthy grains during threshing-time. Every year the recurrence of disease takes place by the contaminated seeds. The mycelium develops from the very beginning, along with the coleoptile and ultimately reaches the ear. During threshing the smut sori break, the smut spores are released and they make the seeds contaminated again.

Germination of Teliospores: The binucleate smut spores or teliospores present in the soil or sticking to the grains germinate in the presence of warmth and moisture when the contaminated barley grains are sown in the field. Prior to germination, the two nuclei of dikaryon in the spore fuse to form a single fusion nucleus or the synkaryon. The diploid teliospore germinates to produce a germ tube, the promycelium or the epibasidium. In the epibasidium, the synkaryon undergoes meiosis to form a row of four haploid nuclei. Segregation of plus and minus strains takes place at the time of division. Two of the nuclei are of plus and two of minus strain. Septa are laid between the nuclei. The epibasidium now consists of four haploid segments or cells. Each segment of the epibasidium produces one uninucleate sporidium or basidiospore. Two of these basidiospores are of plus and two of minus strain. They are ovate to oblong in shape. The basidiospores of covered smut of barley are capable of

multiplying by budding in the presence of nutrition like yeast. The secondary spores produced by budding germinate like the basidiospores and are capable of infecting fresh barley plants.

Infection:

The basidiospores or secondary spores germinate on the surface of the grain. Each produces a slender haploid germ tube. The haploid germ tubes by themselves are incapable of infecting the barley seedlings. The germ tubes from two different basidiospores of opposite, strains growing in the vicinity fuse. As a result one of them becomes dikaryotic. The dikaryotic germ tube or the infection thread infects the barley seedling at a very early stage. The covered smut of barley therefore provides an example of seedling infection. The dikaryotic hypha penetrates the young coleoptile and enters the growing tip of the embryo. There it grows upwards keeping pace with the growing point. It forms a dikaryotic mycelium. The mycelium grows upwards in the leaves and the stem. It grows more vigorously in the stem than in the leaves. By the flowering time the mycelial hyphae reach the inflorescence region and enter the ovaries to produce the smut spores. Infection fails to take place if the primary shoot of the host has come above the soil surface.

Disease Management:

1. Roguing: The infected plants may be uprooted and burnt.
2. Seed selection: Seed must be taken from healthy crop.
3. Seed treatment: The infected seeds may be treated with Agrosan GN, Ceresan, Captan and Thiram @ 2.5 g/kg seeds.
4. Resistant varieties: The resistant varieties should be grown. Some resistant varieties have been evolved. They are K-12, K-409 (Pragati), BJ-13, BJ-14, CN-294, C- 84, Neelam etc

