Course-B.Sc. (Bot.Hons.Part I)
E-content : Online class 22/7/2020

Plant disease

Loose smut of wheat

Causal organism: *Ustilago nuda tritici* (*U.tritici*)

Host: *Triticum aestivum*

Loose smut of wheat is a very destructive disease in the sense that every head of the attacked plants in the crop field is converted into black powdery mass of spores and no grains are formed. This disease is of worldwide distribution, but it is serious problem in the humid and semi humid wheat growing areas. As estimated by Luthra (1953) it causes an annual loss of fifty millions of rupees in Punjab alone.

Symptoms- The disease appears only when the plants produce ears. Diseased ears emerge earlier than the healthy ones. Black powdery mass of spores (teliospores /smut spores) replace the flowers. The pathogen is internally seed borne and being carried with the diseased seeds of previous year, sown in the season. Smutted heads develop in to deformed spikelets, filled with a black, dry, powdery mass of spores which entirely replace the entire floral parts and glumes.

Causal organism- The pathogen of this disease is *Ustilago nuda tritici* (*U.tritici*; Pers.)Rostr.

Spores are produced in very large numbers and are pale olive in colour, spherical/oval.5-9µ in diameter with echinulate spore wall. On germination they produce a three celled monokaryotic hypha known as promycelium, which gives rise to infection threads. This is similar to the species infecting barley *U.nuda*, causing loose smut disease. Fischer (1943) transferred U.tritici to *u.nuda*. However, some difference in germination pattern was noticed by Popp (1955).Loose smut spores of wheat do not infect barley and *vice versa.* Dung early stages of infection the rates of photosynthesis and respiration in diseased plants have been noticed high in comparison to the healthy plants.

Disease cycle-

The disease begins with the fall of smut spores on feathery styles and stigma. They germinate producing promycelium from which the infection threads develop further. The infection thread penetrates the style and grow forward intercellular, which finally reaches to ovary. It takes about ten days to enter into the ovule, where the germ tubes branch and the mycelium ramifies in the developing embryo. Direct penetration of ovary has been reported by some scientists. Finally the fungal mycelium resides in the kernels and becomes dormant. The disease develops at the optimum temperature 23^0 C.

When the diseased seeds are sown In the next crop season, the dormant mycelium becomes active with the germination of the seed. iIt grows ai the developing seedling until it reaches to the growing point , where it grows vigorously. The mycelium grows intercellularly and reaches to the developing

ears. The disease plants develop flowers earlier than the healthy ones. Mycelium destroys the entire tissue of the spike except the rachis. The infected heads become longer than the healthy ones. There is no grain formation in the infected spikelets. The mycelium in infected spikelets gets soon transformed into teliospores.These teliospores are covered by a delicate membrane of host tissue.

On maturity the membrane bursts open releasing large number of smut spore in the field. These teiospores are now ready to infect new healthy hosts.

Disease management-

The pathogen is internally seed borne and carried over to the next crop through seeds, therefore seed treatment is the best measure to control the disease.

1. Solar treatment- Seeds are first soaked in ordinary water at a temperature of 26^0C-30^0C for four hours (8.00am to 12.00 pm) on a bright summer day during May-June. The soaked seeds are then spread as a thin layer and left to dry in the sun for four hours (12.00 noon – 4.00 pm).This is the most common method to control this disease because this treatment kills the dormant mycelium hidden in the diseased seeds. This is widely adopted in Punjab, UP and Bihar states. It is also recommended to soak seeds at the above temperature for four to five hours and then quickly transfer them to hot water at a temperature of 54^0C for ten minutes. The seeds are then left to dry.

Since, the thermal death points of the fungal mycelium and the seed embryo are close to each other, hence extreme care must be taken. The hot water temperature should not be over 54^0C and duration of treatment should not be more than the recommended period.

2. Fungicide treatment- Several systemic fungicides have been recommended for seed treatment.Weibel (1958) suggested immersing seeds in Sodium hypochlorite or Ceresan added water. Treatment of water pre soaked seeds and then immersing in 0.2% suspension of Spergol SL (having 98% tetrachloro para benzoquinone) for 40-50 hours was suggested by Tyner (1953) to control the disease. Vitavax (carboxin) and Bavistin (carbendazim) with a dose of 2.5-3.0 g of fungicide per Kg of seed, has also been suggested to control the infection to a great extent. Vitavax can also be used in combination with Thiram, Maneb, or Copper quinolate.Excellent control of this disease is obtained by seed dressing with systemic fungicide Carboxin(Vitavax) and Benomyl at 0.2-0.25% as recommended by Chatrath and Mohan,1971 ; Nene *et al*.,(1971) and many others.

3. Use of resistant varieties- Many resistant varieties of wheat have been developed in India.Some of them are NP 710,718, 729, 761, 770,791,817,823,865,871 and888,MP 108,144,176,Bansipali 808, Bansi 224 and many other varieties have been recommended for cultivation in Punjab, Rajasthan, UP and Bihar.

Fig.Curtsey: Plant Pathology by G.N.Agrios . Field with heads of barley infected with Ustilago nuda(upper left) ; magnified view of the infected ears(upper right) ; microscopic view of smut fungus mycelium and spores in an infected barley embryo(lower)

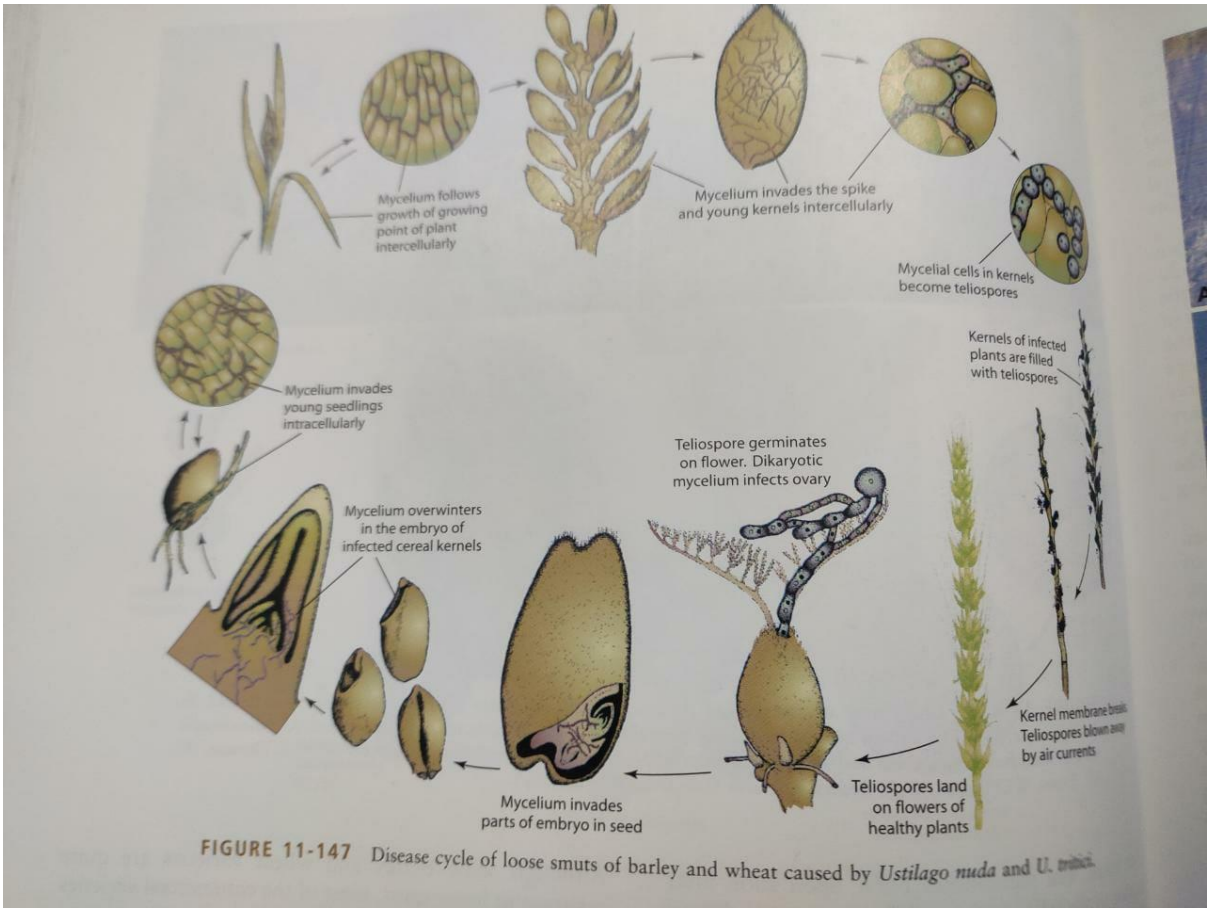

FIGURE 11-147 Disease cycle of loose smuts of barley and wheat caused by *Ustilago nuda* and *U. tritici*.

Fig,. Disease cycle of loose smut of wheat and barley caused by *U.tritici* and *U.nuda* respectively.

Fig, curtesy, Plant Pathology, G.N.Agrios, Elsevier Academic Press)

Fig. Field with infected wheat heads (left), Magnified view of the spikelet of wheat, infected with *Ustilago tritici*. (Curtsey: Plant Pathology by P.D.Sharma,Rastogi publ., New Delhi)