



B.Sc. Third Year, Semester - V
Botany Paper No. XVI (C)
Plant Pathology Unit-2



1) Cereals

a) Black Stem Rust of Wheat

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a) Black Stem Rust of Wheat

Causal Organism: *Puccinia graminis tritici*

Host: *Triticum aestivum* (Wheat)

- **Classification**

- **Division-** Mycota
- **Sub Division-** Eumycotina
- **Class-** Basidiomycetes
- **Sub class-** Heterobasidiomycetes
- **Order-** Uredinales
- **Family-** Pucciniaceae
- **Genus-** *Puccinia*
- **Species-** *graminis tritici*

Distribution

The rust usually appears late in the season when the temperature starts rising. It is often not seen until March or even later in northern India when the crop is in earing or maturing stage.

The stem rust is a serious threat to wheat in India. The annual loss from rusts in India was estimated to be about Rs. 40 million (Butler and Hayman, 1906). The losses include reduction in grains, its poor quality and shriveled lighter grains. These effects are due to two factors:

- 1. Rubbing off of the food by the pathogen for its own use.**
- 2. Excessive transpiration due to numerous slits in the host tissue.**

These factors result in lessened metabolism, in partial sterility, reduction in the number of the grain in the head and shriveled grain.

Symptoms:

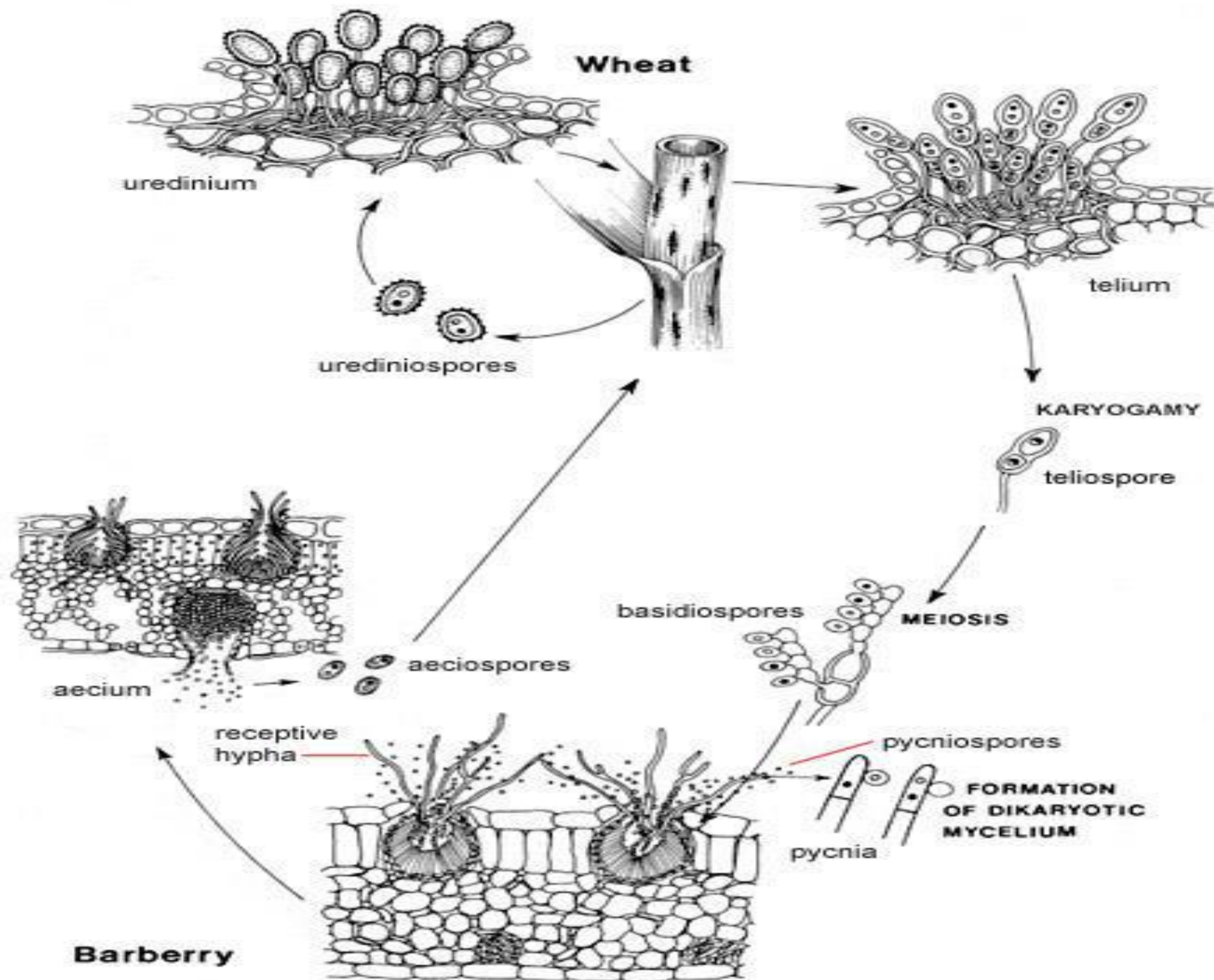
The rust appears in the form of elongated, reddish brown pustules (uredinia), primarily on the stem, followed by leaf sheaths and leaves. Thus, stem is most severely attacked (stem rust). The uredinia frequently merge with each other and soon burst exposing the brown powder of urediniospores, surrounded by ruptured epidermal fringes.

Another kind of pustules (telia) develops later in the same sorus or independently. Telia are darker and by this time pustules change from brown to almost black colour. These are also most prominent on culms, followed by leaf sheaths and leaves. A number of physiological changes are brought about by rust infection.



Causal organism and disease cycle:

Black stem rust is caused by *Puccinia graminis tritici*. The hyphae in wheat leaves and stem are intercellular with small round or branched haustoria. From this mycelium urediniospores develop in uredinia beneath the epidermis. Each urediospore is oval, stalked, brown, body, 25-30 X 17-20 μm single celled with echinulate exospores. There are four germ pores along an equatorial band. As host epidermis ruptures, urediospores disseminated by wind. They germinate on healthy parts of plant causing secondary infection. Thus urediospores propagate the disease in the entire field.



Wheat stem rust, caused by *Puccinia graminis tritici*

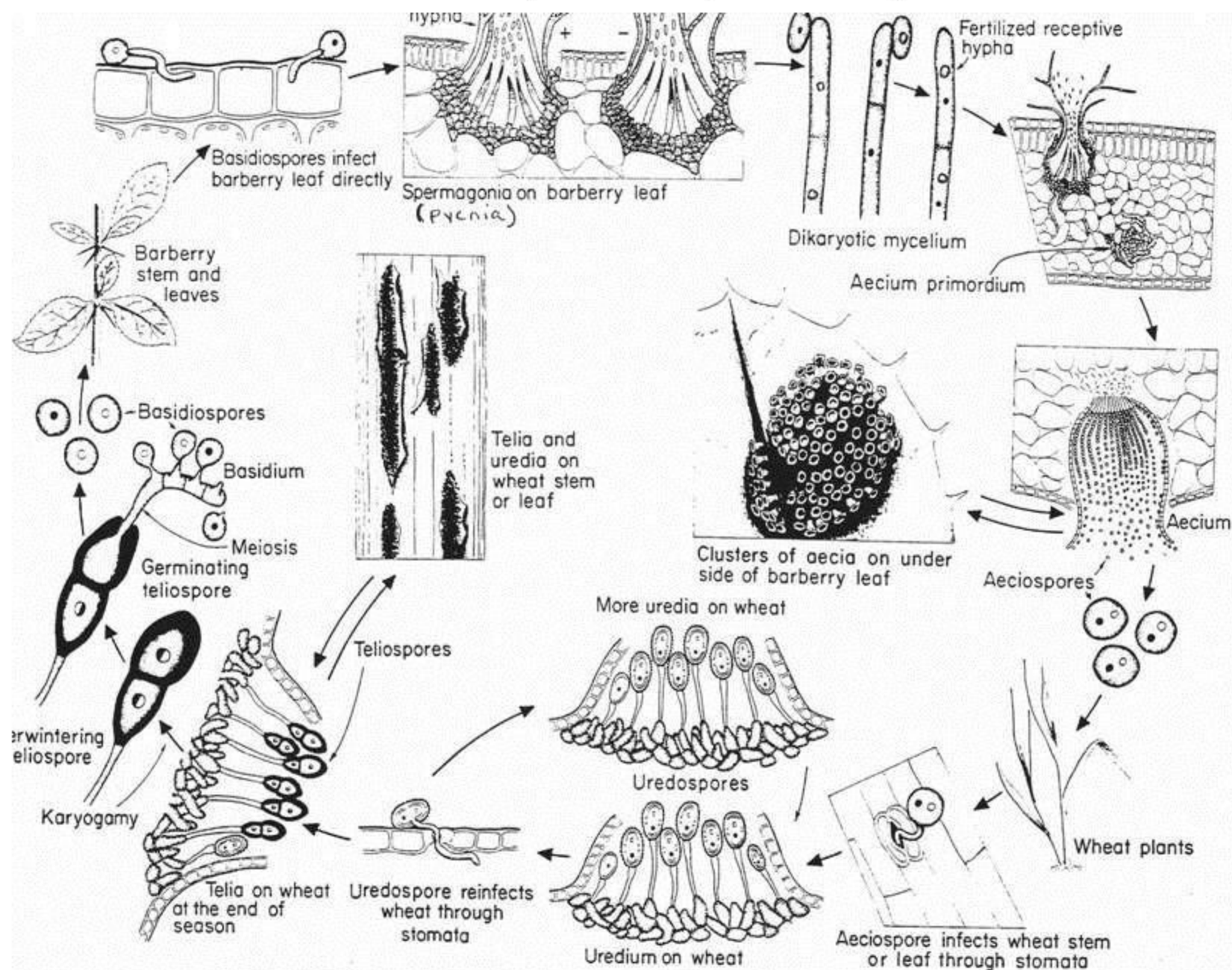


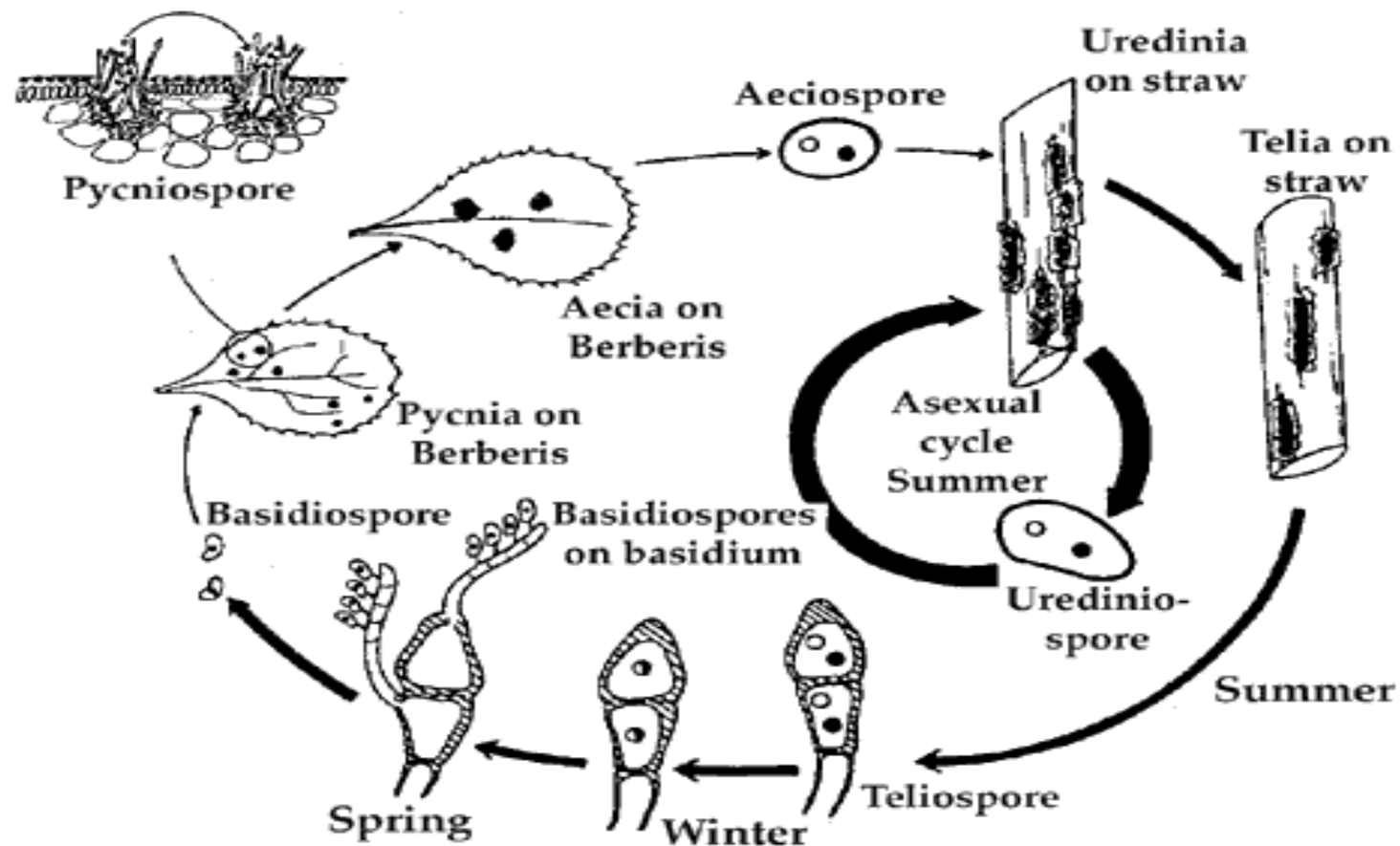
FIGURE 11-97 Disease cycle of stem rust of wheat caused by *Puccinia graminis tritici*

Later in the season, telia begin to develop from the same mycelium in stem, leaf sheaths and leaves. Telia are more frequent on stem. Telia are oblong to linear, dark brown to black exposed through the rifted epidermis. Each teliospore is stalked, two celled with a thick smooth wall. The apex is round or pointed. Spores are of chestnut brown colour, 40-46 X 15-20 μm . each spore has a germ pore, that of upper cell at the apex, and that of the lower at one side just below the septum. Teliospores undergo a period of rest for several months. In India, these spores are unable to survive the hot summer temperatures following the harvest of crop. However, if conditions are suitable each cell of teliospore germinates to form a four-celled promycelium. From each promycelium, four haploid basidiospores are formed on sterigmata.

***Puccinia graminis tritici* is heterocious rust as its basidiospores cannot infect wheat but infect *Berberis* spp which serve as alternate hosts. About 83 species of *Berberis* are known world over to be infected by *Puccinia graminis tritici*. Of these *B. aristata*, *B. coriaria*, *B. lycium* and *B. vulgaris* are that important ones. Wind borne basidiospores infect the young tissues of this plant. On germination, basidiospores give rise to haploid mycelia inside barbery leaf. This mycelium develops special structures on both sides of barbery leaf.**

Spermogonia are flask shaped structures on the upper surface. Each spermogonium has an ostiole with some paraphysis. Inside it are spermatia. Sexual fusion occurs between spermatia and flexous hyphae of spermogonia of opposite strains. The dikaryotic mycelium thus developed, then forms another type of structures called aecia on the lower surface of leaves. Aecia are yellow, cup shaped receptacles enclosed by peridium. Each aecial cup contains chains of aeciospores. The aeciospores are yellow, verrucose and with six germ pores. On germination they give rise to germ tubes which can infect only wheat. Thus aeciospores infect wheat leaf through stomata.

Life Cycle of *Puccinia graminis*



Control measures:

1. Cultivation of rust resistance varieties:

The rust resistance varieties should be cultivated for combating the disease. Some varieties are available in India, NP718, and NP770 and newly breed hybrid NP822, NP823 and NP825 have given good results. The recently introduced dwarf Mexican wheat varieties such as Sonora 64 and Lerma Rajo are almost completely resistant to rust.

2. Eradication of Barbery:

It was believed that eradication of barbery is a possible means of eliminating the disease. But control of stem rust by this method is not possible in India. The uredospores which are able to survive to stray and self sown wheat plants on the hills serve as inoculums.

3. Use of fungicides and antibiotics.

Thank you