

Phylum Basidiomycota

order: Uredinales

The Rust Fungi

Fungi belonging to the order Uredinales commonly are referred to as rust fungi. There are 5000 species of this order belonging to 140-150 different genera. Economically speaking, these are among the most important of all Basidiomycota species. All are parasitic on plants, often causing great losses to many cultivated crops. In the past, Romans celebrated a festival to please "Rust god" "Robigus", and festival name was "Robigalia". Rusts are obligate parasite i.e. only can survive on living tissues. Rusts can attack various crops and may produce various types of symptoms, like; tissues malformation, sunken necrotic lesions, cankers, abnormal branches (witch's-flowers) and may effect flowers. ^{on} affected ~~these~~ flowers are called "pseudoflowers", in produced. The most common symptom of rust is, the production of rusty powder over the foliage portion of the plant. Rust affected leaves reduce photosynthetic rates and chlorophyll levels. Rusts adversely affect the transpiration of the foliage portion of the plant. Rust fungi may produce as many as five different stages in their life cycle. Each spore stage of life cycle is given roman numerals.

The stages of life cycle of rust are as follows;

Stage 0 = Spermogonia bearing spermatia (n) and receptive hyphae (n)

Stage I = Aecia bearing aeciospores (n+n)

Stage II = Uredia bearing urediospores (n+n)

Stage III = Telia bearing teliospores (n+n → 2n)

Stage IV = Basidia bearing basidiospores (n)

Based on life cycle pattern, species of Uredinales may be divided into three categories (I), macrocyclic forms (II), Demicyclic forms (III), microcyclic forms.

- Macrocyclic forms: Have all five stages of life cycle.
- Demicyclic forms: Lack uredinial stage but have all rest of four stages.
- Microcyclic forms: Lack uredinial and aeciospore stages, but have rest of three.

Rusts complete their life cycle on two different hosts, this condition is known as "heteroecism" while, there are rusts which complete their life cycle on the single host, this condition is known as "autoecism". In "heteroecism" one host is called primary host while other is called alternate host.

O = Spermogonia:-

Rusts produce spermogonia which comprise of spermatia and receptive hyphae. spermatia work as male sex organs (cells) while receptive hyphae behave as female sex organs (cells). Spermogonia are produced from primary, homobasidial mycelia growing in the tissues of their host. Spermogonia are produced after four days of infection.

I - Aecia and Aeciospores:-

Aecia and aeciospores form next in the rust life cycle. The term aecium comes from Greek aikia, which means injury and refers to the blisters on the host resulting from the formation of aecia by the parasitically dikaryotic hyphal cells within chains of dikaryotic aeciospores.

II - Uredinia and Urediniospores:-

Urediniospores consist of so-called repeating stage of the rusts since several "crops" of spores may be produced in one growing season. They are borne in structures resembling aecia but that are called uredinia (sing. uredinium; L. urere = to burn) because of their reddish colour. The uredinial cells are formed subepidermally from dikaryotic mycelium originating from the germination of an aeciospore or an earlier germination urediniospore.

Urediniospores are thick-walled, dikaryotic and are covered with minute spines.

Telia and Teliospores:-

Telia (sing. telium) are groups of binucleate cells that give rise to special thick-walled cells called teliospores - also termed as teleutospores. In many rust fungi the old uredinia actually are converted to telia. Typically, large numbers of teliospores protrude from the surface of the infected host. Teliospores, which may be unicellular or composed of two or more cells, are formed from the tips of binucleate cells of telium.

In teliospores consisting of more than one cell, each cell is capable of ~~more than one cell~~ germinating and giving rise to a promycelium bearing basidiospores. External basidia are, however, not produced by teliospore of all species. In some species meiosis is completed in the teliospore, and basidia are produced internally as a result of the division of a teliospore cell into four cells. Each of these cells then germinates and produces a basidiospore outside the teliospore. Teliospores are smooth, some spiny, and others variously sculptured.

Basidia and Basidiospores :-

The basidiospore is typically a unicellular, haploid structure. As already noted, basidiospores usually receive a single nucleus

from the basidium, although in some instances two nuclei may move into the same spore. Rust teliospore is a probasidium. When favourable conditions for germination arrive, in most species the promycelium grows out from each cell of the teliospore. Next ^{the} diploid nucleus migrates into the promycelium, after that, meiosis takes place. The four haploid nuclei become distributed at more or less equal distances from each other in the promycelium and septa develop between themselves to divide the promycelium into four uninucleate cells. Each of these cells then produces a sterigmata at the tip of which typically bear a kidney shaped basidiospores develop. Mature basidiospores possess a thick wall and lack surface markings.

Rust fungi are self-sterile therefore known as heterothallic fungi. Stages 0 and I are produced on Barberry while II and III are produced on wheat. Stage IV i.e. basidia do not cause infection on primary and alternate hosts. The spores which produce rusts are infect Urediniaspores. However, when their colour become black, they are teliospores, not Urediniaspores.

Concept of formae speciales :- (Sing. forma specialis)

Forma speciales are named after the host plants they attack and are designated by adding the abbreviation "f.sp." and a third name to the Latin binomial. These may be defined as "Fungi that are either very similar or identical morphologically but differ in their abilities to parasitize a host species or a group of host species. Forma specialis often are composed of populations of individuals of the same genotype referred to as "biotypes". A group of biotypes with a similar virulence-avirulence pattern on a particular group of plants is called "race". Races attack on a particular cultivar (variety).
 e.g, Puccinia graminis f.sp. tritici

The End