

FALSE SMUT: AN EMERGING DISEASE IN NORTHERN PART

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Rice is a tropical plant, it is grown in hot and humid climate. Rice production plays important role in Indian economy. India is the world's 2nd largest producer accounting for 22% of the world's rice production. It suffer from many major and minor grain diseases limiting its production. Among the minor disease false smut caused by the fungus *Ustilaginoidea virens* is now becoming major constraint in the many part of northern states and occasionally develops epidemic in certain areas and change from minor to major disease. World wide, false smut of rice is also known as green smut or pseudo-smut also considered as Lakshmi disease in all rice growing countries, Bashyal *et al.*, 2020.

Pathogen

Rice false smut disease is caused by the fungal pathogen *Ustilaginoidea virens*, which produces both asexual chlamyospores and sexual ascospores in its life cycle. The teleomorph of *Ustilaginoidea virens* is *claviceps virens*. In the later autumn pathogen produce sclerotia and overwinters in the soil, Gupta *et al.*, 2019. They germinate and produce spores that infect the grain.

The disease first appears as a large gray to brownish-green fruiting structure covered by a thin membrane that replaces one or more grains of the mature panicle. The membrane ruptures, exposing orange spores. In the centre of the ball is a hard structure called a sclerotium that replaced the grain. As the spore balls mature, they turn khaki green to black spores contaminate adjacent grain. The spore balls reduce grain quality. The disease flourish more with high nitrogen and is more common on later planted rice, Gupta *et al.*, 2019. If the infection occurs before fertilization most of the glumes remain sterile without any visible sign of infection.



Disease Cycle

The fungus *U. virens* has a peculiar life cycle. Just after infection, it produce White hyphae on the floral organs of the rice crop. As the infection proceed, darker brownish green chlamyospores are produced on the rice spikelets. Later in the season sclerotia can be seen. *U. virens* produces both a sexual (ascospores) stage as well as an asexual (chlamyospores) stage. The chlamyospores are the main survival structure, and they can live in the soil for up to four months. The pathogen can survive even longer almost up to a year due to the formation of very hard structure i.e sclerotia. These sclerotia form an ascocarp (fruiting body)

on maturation either on or below the soil surface, Guljar *et al.*, 2017. The ascospores act as the primary source of infection and spread disease throughout the paddy field.

Infection

Before heading, the pathogen invades at the apex of a rice spikelet through small gap. According to Ikegami, 1963, chlamydospores in the soil is the primary source of infection. The fungus colonizes the tissue on the growing points of tillers specially during the vegetative stage of the growth of the rice crop when conidia get deposited on the spikelets of the rice crop, which later lead to the growth of hyphae. The mycelia from these hyphae invade the floral organs in the spikelets.

Disease Control

The pathogen causes qualitative damage and quantitative loss to the rice crop. In many region it becoming a serious disease, so its management is necessary. It can be done by host plant resistance. Planting rice earlier in the season can also reduce the amount of inoculum of the pathogen thus restricting the disease from initiating. Disease can also prevent by managing the application dose and time of fertilizer in the soil, large amount lead to increase in disease. Maintaining the nitrogen rate in the soil to a level below 160 pounds per acre has proven to be most efficient against stopping disease. Although there are no specific fungicide recommendations for the eradication of the false smut pathogen of rice, Cartwright reported that propiconazole and copper foliar sprays were most effective when applied at the boot growth stage suppress disease development. Plant products such as leaf extracts and plant oils could also be used to control rice false smut bulb extract of garlic (*Allium sativum*), rhizome extract of turmeric (*Curcuma longa*), leaf extracts of lantana (*Lantana camara*) and bael (*Aegle marmelos*), whereas plant oils of lemon grass (*Cymbopogon flexuosus*) cinnamon (*Cinnamomum zeylanicum*), and palmarosa (*Cymbopogon martinii*) have completely inhibited the growth of *U. virens*.

Biological control

Bacillus subtilis was reported to be effectively against the disease. *Trichoderma viride*, *Trichoderma virens*, *Trichoderma harzianum* and *Trichoderma reesei* obtained from rice rhizosphere under in vitro condition are very potential antagonist biocontrol agents.

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