SHEATH ROT DISEASE IN RICE AND ITS MANAGEMENT

S. R. Prabhukarthikeyan, U. Keerthana, S. Raghu, B. Jeevan, M.K. Bag and S. D. Mohapatra

Introduction

Rice, as a vital crop, serves as the primary food source for over half of the world's population. Moreover, it finds extensive applications in diverse industries and serves as a vital component in animal feed. Cultivation of rice is widespread across a range of agro-ecological zones, primarily in tropical and subtropical regions, with a significant focus in Asia. However, the cultivation of rice is generally subjected to several environmental stresses, such as disease outbreaks. Rice production is constantly threatened by several diseases. Sheath rot disease, caused by *Sarocladium oryzae*, is the most prevalent and damaging fungal disease affecting rice cultivation worldwide. This disease significantly reduces the economic and commercial value of rice. Sheath rot has become a serious productivity constraint in rice due to its ability to develop in both rainfed and irrigated habitats, affecting all rice cultivars. This disease used to be considered geographically limited, but it has become widespread in major rice planting areas in recent years. The sheath rot pathogen can infect the rice plant at any growth stage, but its impact is most severe when infection takes place prior to panicle emergence. This leads to the development of husky, discolored grains, which adversely affect seed viability, quality, and nutritional value. Different plant protection methods, including resistant varieties, chemical fungicides, and biological agents, are available strategies to manage the disease.

Disease occurrence and yield loss

The occurrence of sheath rot disease has been documented with a Percent Disease Index (PDI) of up to 43% in Odisha, 34% in Jammu, 37% PDI in Karnataka, and 30% in Tamil Nadu. In most cases, the disease results in yield reductions ranging from 20% to 30%. However, in various regions around the world, particularly depending on the weather conditions during the crop growth phase, there have been reports of severe losses reaching as high as 70% to 85%.

Pathogen

The primary fungal pathogen associated with sheath rot disease of rice is *Sarocladium oryzae*. This genus belongs to the order Hypocreales within the Phylum Ascomycota. The fungus displayed features such as pale, thinly branched mycelium with clear septations. Conidiophores originating from the mycelium were thick and displayed one or two branches with 3-4 branches per whorl. The terminal branches gradually narrowed towards the tip. The conidia were translucent, smooth, lacked septations, and had a cylindrical shape with dimensions ranging from 3.20-6.34µm x 2.45-3.75µm. The average size of conidia was approximately 7.16µm x 2.57µm.

Sarocladium oryzae

Later on, other pathogens such as *Fusarium fujikuroi* complex and the bacterial pathogen *Pseudomonas fuscovaginae* got themselves enlisted as the causal organisms. *Fusarium proliferatum* was first time reported from Cuttack that causing sheath rot disease in Eastern India. On Potato Dextrose Agar (PDA), the colonies exhibited copious white aerial mycelium accompanied by violet to pink pigmentation. The hyphae were transparent with distinct septations. The culture produced a plentiful number of single-celled, oval-shaped microconidia measuring 5.5-9 × 1.5-2 µm, while macroconidia were absent.

Fusarium proliferatum

Symptom

The symptom begins with the discoloration of the flag leaf sheath in the infected sample. The infected lesions exhibit a wide range of characteristics, from regular to irregular shapes and small to large patches, distinguished by a dark brown thick margin and an ashy-coloured centre. In the partially emerged panicle, the grains take on a brown to black hue. Lesions on the upper flag leaf progressively expand, often merging to completely envelop the entire leaf sheath. In severe cases, the young panicle remains trapped within the sheath, leading to its rotting. Notably, a whitish powdery growth is also present inside the infected sheath and young panicle. A significant consequence of this infection is the detrimental impact on the grains within the infected panicles. Almost every grain in these panicles becomes shrivelled, partially filled, and discoloured.

Sheath rotting symptoms

Powdery growth and discoloured grain

Pathogenicity

S. oryzae is multiplied on chaffy grains in 250 ml conical flask. Chaffy grains (200g) were added with 50 ml of water and sterilized. The flasks are inoculated with 15mm mycelial discs of the pathogen. After a period of twenty days, the chaffy grains fully grown with *S. oryzae* are inserted between the boot leaf sheath and panicle of each tiller Then they wrapped with moist cotton. The plants that were inoculated were consistently monitored until the initial signs of sheath rot symptoms appeared. The observations were documented on mature flag leaf sheaths of 15 randomly chosen plant tillers, employing the 0-9 rating scale established by the Standard Estimation System (SES) as per IRRI guidelines from 2013.

Artificial inoculation on rice

Favourable condition

- Dense planting, high doses nitrogen, temperatures ranging between 20-30°C and relative humidity between 65–85% support disease development
- Late planting combined with low temperature and higher humidity is found to be favourable for disease development
- Insect and mite damage facilitate the entry of the pathogen into the plant

Mode of spread and survival

- The pathogen persists in diseased seeds, plant residues (straw, stubble) and soil
- Secondary infections mainly through air-borne conidia

Management

Cultural method

- Infected stubbles should be removed after harvest
- Optimum crop spacing should be given to reduce the disease
- Avoid dense planting and heavy dose of nitrogen application
- Apply potash at tillering stage
- Control weeds and keep the field clean

Biological method

- Seed treatment with *Trichoderma viride* (or) *Bacillus subtilis* @ 10g/ kg of seed.
- Foliar spray of *Pseudomonas fluorescens* (or) *Bacillus subtilis* @10g/lit of water at boot leaf stage. Depending on the disease intensity, the foliar spray can be repeated twice or thrice in 10 days interval.
- Application of neem seed kernel extract at a concentration of 5% or neem oil at a concentration of 3%. Initiate the first application at the boot leaf stage, followed by a second spraying 15 days later.

Chemical method

- Seed treatment with Captan or Thiram at 2g / kg of seed.
- Spray Propiconazole 25EC @ 1ml/lit (or) Hexaconazole 5% SC @ 2ml/lit of water twice at 15 days interval at boot leaf stage.

NRRI Technology Bulletin No-207
March-2024

An ISO 9001: 2008 Certified Institute
Phone: +91-671-2367757; PABX: +91-671-2367768-783; Fax: +91-671-2367663;
Email: director.nrri@icar.gov.in | directorcrricuttack@gmail.com

Typesetting: ICAR-National Rice Research Institute, Cuttack-753006, Odisha
Published by: The Director, ICAR-National Rice Research Institute, Cuttack (Odisha) 753006
Printed at: Printtech Offset (P) Ltd., Bhubaneswar