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Blast Disease: A Threat to Finger Millet Cultivation and Management

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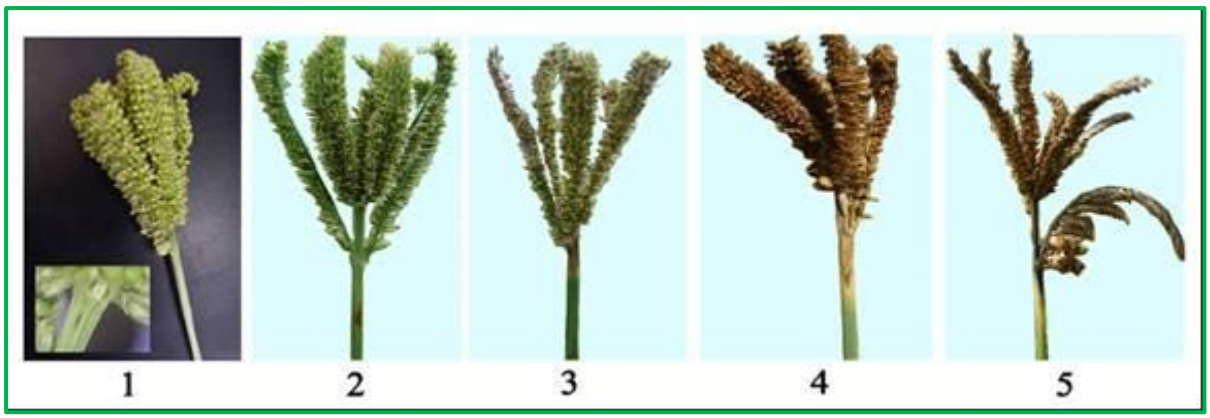
FINGER millet (*Eleusine coracana L. Gaertn*), is one of the most significant small millets in the tropics (12% of global millet area) and is grown as grain and fodder crops in over 25 nations across Africa and Asia. It constitutes a little over 25% of the food grains grown in India. Nutritionally it is almost as good as or better than wheat or rice. The major proteins of ragi are prolamins and glutenins and they appear to be adequate in all the essential amino acids. Ragi is rich in minerals especially calcium. It is also rich in fibre.. It contains B-vitamins but is poor in B2. Malting of finger millet is a traditional process followed in India and is used in infant foods and in milk thickener formulations, conveniently called ragi malt. Regular use of finger millet has a number of health advantages, including hypo cholesterolemic, hypoglycemic, and anti-ulcerative properties. The nutritional quality of finger millet grain makes it an ideal food for expectant women, lactating mothers, children, the sick, and diabetics. In India, the area under finger millet cultivation is declining, as is the production, although productivity has grown with time due to the introduction of new and improved varieties. Finger millet is more adaptable to a wide range of environmental and climatic conditions than most other tropical cereals, thrives at greater elevations (up to 2,300 m amsl) and withstands salinity better than most cereals. This resilience of the crop to hot and dry climates or CO_2 deficient conditions may be due to its C_4 nature.

Despite being one of the hardiest crops, finger millet is susceptible to a variety of diseases, including blast, sheath blight, seedling blight, foot rot, smut, leaf spot, green ear, damping off, streak, and mottling viruses. As many as 25 fungal, 4 viral, 5 bacterial and 6 nematode pathogens are found to attack this crop. Among these, the blast caused by Pyricularia grisea (Cooke) Sacc. [teleomorph: Magnaporthe grisea (Hebert) Barr] is the most destructive disease. According to reports, India's average loss from blasts ranges from 28-36% and in endemic areas, vield losses could be as high as 80-90%. In India, McRae (1922) was the first to document the occurrence of blast in finger millet in the Tanjore area of Tamil Nadu. After that, this disease has been reported in different states of India as well as in different other countries like Uganda, Kenya, Tanzania, Zambia, Somalia, Nepal, Japan, Sri Lanka and others.

Blast disease symptoms: The pathogen puricularia grisea infects all portion turns whitish and gradually disintegrate. On younger leaves, they grow up to several centimetres long and 1.0 cm wide while remaining round on older leaves. As the lesion progresses, the core area takes on a water-soaked appearance and turns light green or dull greyish green.



Changes in environmental circumstances as well as varietal response affect the form, size, and colour of the lesions. A susceptible cultivar may develop a number of greyish spots that, in favourable conditions, become larger, broader, and combine, causing the entire leaf to wither. Older leaves develop a greyish or nearly straw-coloured centre. The leaf sheath also develops similar symptoms.

The grey fungal growth consisting of the conidiophores and the conidia, especially on the upper surfaces of the leaves, may cover the centre areas of lesions when the environment is humid. The lesions are discrete in the early stages of the infection but frequently merge fast and cover large regions. The farthest parts of the leaves beyond the lesions might dry up, break and fall off. When young, healthy seedlings get infected, their leaves have a burned appearance owing to severe leaf blight and eventually die. Along with decreasing the yield, it also negatively affects the quality of the grain and the biomass of the plant, making the leaves unfit for use as animal feed.

Neck blast: The pathogen damages the culms, particularly at the nodal region, causing that area to become blackened. Symptoms of blast disease on the neck appear as elongated, initially brown, then black lesions, which are most frequently visible 1-2 inches below the ear and rupture at the infected location where sporulating fungus can be seen. The neck infection stage is the most devastating which can result in significant losses in grain quantity and weight, and cause an increase in spikelet sterility. The infected plants may be clearly identified by the blackish patch on the neck area. The grains are not filled and the panicle stays upright if the infection starts well before the development of the grains. If the infection occurs after some grains have developed, the panicle hangs down. However, the ear often breaks and falls off because of the necrosis of the neck tissues.

A higher degree of neck blast also causes a higher level of seed infection and lower seed viability. This is because the blast fungus weakens the vascular, parenchymatous, and sclerenchymatous tissues of the neck area, which prevents nutrition from reaching the grains.

Finger blast: The symptoms start at the tip of the finger and spread to the base before turning brown. In the affected areas, the fungus attacking the head results in inadequately formed grains or extensively blasted florets. The base of the fingers fails to expand further when an infection develops nearby, although the rest of the ear may continue to grow properly.

The grains may turn black and sometimes the entire finger length of the ear is impacted. As the infection destroys the growing grains, shrivelled, blackened see, appear. When the infection is at the seed-setting stage, empty fingers are seen. Under-developed seeds are produced when the disease infects later.

Management

Several disease management methods such as cultural, chemical and biological control have been recommended with variable success to reduce losses caused by the disease.

Cultural management: Use of resistant varieties is always preferred because it reduces the yield losses and management costs which accompany the disease. Several blast-resistant varieties have been released from past years to till-date.

• The best time to plant medium to late-maturing varieties of finger millet is the second fortnight of July in order to avoid finger millet blast, but early-duration cultivars may be sown as late as the first fortnight of August.

• It could be because the crop's panicle emerging stage was more vulnerable to pathogenic invasion, which happens to coincide with favourable circumstances and virulent pathogens.

• High plant density should be avoided. Managing seed rates, increasing the spacing and weeding of the finger millet fields two or three times to eliminate weed hosts are known to reduce finger millet blast disease levels.

Biological management: use of biocontrol agents such as pseudomonas fluorescens (0.6%) and trichoderma haziamum (0.3%) as field spray as well as in seed treatment greatly reduce finger millet blast.