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Management Potentialities Of Rice Blast Disease Caused By Magnaporthe Grisae Using New Nanofungicides Derived From Chitosan

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Abstract : Various abiotic and biotic stresses have an impact on rice production all around the world. The most serious and prevalent disease in rice plants, known as rice blast, is one of the major obstacles to the production of rice. It is one of the diseases that has the greatest negative effects on rice farming globally, the disease is caused by a fungus called Magnaporthe grisae. Since nanoparticles were shown to have an inhibitory impact on certain types of fungus, nanotechnology is a novel notion to enhance agriculture by battling plant diseases. Utilizing nanocarrier systems enables the active chemicals to be absorbed, attached, and encapsulated to produce efficient nanodelivery formulations. The objectives of this research work were to determine the efficacy and mode of action of the nanofungicides (in-vitro) and in field conditions (in-vivo). Ionic gelation method was used in the development of the nanofungicides. Using the poisoned media method, the synthesized agronanofungicides' in-vitro antifungal activity was assessed against M. grisae. The potato dextrose agar (PDA) was amended in several concentrations; 0.001, 0.005, 0.01, 0.025, 0.05, 0.1, 0.15, 0.20, 0.25, 0.30, and 0.35 ppm for the nanofungicides. Medium with the only solvent served as a control. Every day, mycelial growth was measured, and PIRG (percentage inhibition of radial growth) was also computed. Every day, mycelial growth was measured, and PIRG (percentage inhibition of radial growth) was also computed. Based on the results of the zone of inhibition, the chitosan-hexaconazole agronanofungicide (2g/mL) was the most effective fungicide to inhibit the growth of the fungus with 100% inhibition at 0.2, 0.25, 0.30, and 0.35 ppm, respectively. Then followed by carbendazim analytical fungicide that inhibited the growth of the fungus (100%) at 5, 10, 25, 50, and 100 ppm, respectively. The least were found to be propiconazole and basamid fungicides with 100% inhibition only at 100 ppm. The scanning electron microscope (SEM), confocal laser scanning microscope (CLSM), and transmission electron microscope (TEM) were used to study the mechanisms of action of the M. grisae fungal cells. The results showed that both carbendazim, chitosan-hexaconazole, and HXE were found to be the most effective fungicides in disrupting the mycelia of the fungus, and internal structures of the fungal cells. The results of the field assessment showed that the CHDEN treatment (5g/L, double dosage) was found to be the most effective fungicide to reduce the intensity of the rice blast disease with DSI of 17.56%, lesion length (0.43 cm), DR of 82.44%, AUDPC of 260.54 Unit2, and PI of 65.33%, respectively. The least treatment was found to be chitosan-hexaconazole-dazomet (2.5g/L, MIC). The usage of CHDEN and CHEN nanofungicides will significantly assist in lessening the severity of rice blast in the fields, increasing output and profit for rice farmers.

Keywords : chitosan, hexaconazole, disease incidence, and magnaporthe grisae
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