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Efficacy of Plant Extracts in Controlling Seed Fungal Infections and Enhancing Germination of Annual Wild Rice: *Oryza nivara* in Sri Lanka

Bandara, D.M.A.D.¹, Madushanka, K.S.J.¹, Arosha, K.P.L.¹, Thilakarathne, W.L.S.M.I.D.M.¹, Jayasooriya, W.J.A.P.M.¹, Ratnasekera, D.^{2*}

¹Faculty of Graduate Studies, University of Ruhuna, Matara, Sri Lanka

²Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Kamburupitiya, Sri Lanka

*disnar@agbio.ruh.ac.lk

Abstract

Wild genetic resources of rice play a crucial role in improving climate-resilient rice. Among them, *Oryza nivara* is closely related to the cultivated rice. Poor germination ability, prolonged time for germination followed by fungal infections, uneven germination, and strong dormancy are certain practical constraints in adopting *O. nivara* seeds in research programs. This study aims to assess the antifungal effects of plant leaf extracts on reducing fungal infections and improving the germination percentage of *O. nivara* seeds. Four aqueous plant extracts from fresh leaves of *Zingiber zerumbet*, Guava (*Psidium guajava* L.), Cinnamon (*Cinnamomum verum*), and *Cassia alata*, with the 1:1 (100 g leaf crushed in 100 ml water) and 1:2 (100 g leaf crushed in 200 ml water) in 15 min, standard fungicide solution (S) (2gL⁻¹ of Manganese ethylene-bis-dithiocarbamate), a control using distilled water (C), have been employed with a total of 16 treatments. The experiment was conducted in a completely randomized design with 10 seeds per replicate and 3 replicates for one treatment. Husked and dehusked seeds were treated for 24hr, incubated at 36 °C, and assessed every two days. Optimal germination occurred after 10 days. Data were analysed using one-way ANOVA (p<0.05) and Tukey's HSD test. Seeds with husks failed to germinate and showed no fungal contamination, with all treatments showing that dehusking is compulsory to induce germination. The best germination % was recorded in treatments with both ratios of *Zingiber zerumbet* (1:1=7.33±0.33^{cd}; 1:2=8.00±0.0^d) and Cinnamon 1:2 (7.33±0.33^{cd}) compared to the control (C) and standard (S) (C=5.33±0.33^b and S=6.67±0.33^c), respectively. The least germination rates (1:1=2.67^a±0.33 and 1:2=2.00±0.0^a) were observed in *C. alata* treatments, inferring negative effects on germination. Moreover, *Z. zerumbet* (1:1 and 1:2), *P. guajava* L. (1:1), and *C. verum* (1:1) exhibited the lowest fungal infection, while *C. alata* (1:1) demonstrated the highest mean fungal seed infection (7.33±0.33^d) than the control (C=3.00±0.0^c) and the standard (S=1.00±0.58^b). *Z. zerumbet* bioactive compounds, especially zerumbone, enhanced antifungal activity and seedling growth. Additionally, *C. alata* exhibits allelopathic effects that inhibit seed germination. Previous *O. nivara* germination studies reported low rates of 23.11% (dehusking) and 15.56% (dry heat). Our study achieved significantly higher rates (73.3-80%). Overall, both ratios of *Z. zerumbet* could be recommended as the best leaf extract to minimize fungal attack while increasing germination ability of *O. nivara* seeds.

Keywords: Antimicrobial properties, Aqueous extracts, Microbial infection, Sustainable, Wild rice