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Fungal Diversity of Capsicum (*Capsicum annuum* L.) Rhizospheric Soils from Five Different Agroecological Zones of Sri Lanka

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Abstract

Capsicum annuum L. is a vegetable cash crop widely consumed around the world. The excessive use of agrochemicals throughout its cropping cycle has led to many environmental and health hazards which necessitates research for alternatives to chemical use. Some rhizospheric fungal species are known to improve plant health and productivity. Thus, this study aimed to investigate the culturable fungal diversity and composition associated with the rhizosphere of commercially grown capsicum varieties across the country to determine their species diversity. Rhizospheric soil was collected from capsicum varieties Muriya, HYW, and CA8 cultivated in five different agroecological zones i.e., DL1b, IM3c, WL3, WL1a, and WU2a, in Anuradhapura, Kandy, Kalutara, Colombo, and Nuwara Eliya districts respectively. From each zone, ten healthy, two-month-old capsicum plants were collected randomly. The soil adherent to the root system of each plant was collected and 10 g composite soil samples were prepared for each zone and used for fungal isolations onto potato dextrose agar (PDA) by dilution plate method. The isolated fungi were grouped based on morphology, and 45 representative isolates were selected for molecular characterization. The genomic DNA of these isolates was subjected to PCR amplification of the Internal Transcribed Spacer (ITS) regions and Sanger sequencing. Resulted sequence contigs were identified based on 99-100% similarity to sequences of the NCBI database through BLASTn searches (E<1e-50). The results showed that 45 isolates belonged to 29 different species in 14 genera, 13 families, and seven orders. The most dominant phylum was Ascomycota, with 95.56% relative abundance, with the most abundant fungal genus being *Penicillium* (33.33%). The dominant species reported among all the agroecological zones were *Penicillium raperi*, *Penicillium soli*, *Trichoderma asperellum*, and *Aspergillus terreus*. Seven species were isolated from more than one zone whereas twenty-two fungal species were unique to individual zones reflecting the variation in fungal community composition across the five zones studied. Alpha diversity indices (Shannon H', Simpson 1-D, and Inverse Simpson 1/D) were computed using R Software to assess the fungal diversity within the studied agroecological zones. Zones WL3 and WL1a, both cultivated with capsicum variety HYW, showed the highest diversity, species richness, and species abundance as compared to the other zones assessed. Further characterization of these diverse fungal species will provide insights into their potential use as bioinoculants for optimizing growth and disease control in capsicum cultivations.

Keywords: *Capsicum annuum* L., Rhizosphere, Fungal diversity, Agroecological zones, ITS