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Research Article

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Preliminary Results on Reaction of Tomato Cultivars to *Rhizoctonia Solani* Under Controlled Conditions

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Abstract Tomato (*Solanum lycopersicum* L.) is an important vegetable crop grown widely throughout the world, which suffers from several destructive diseases. *Rhizoctonia solani* Kühn is a soil-borne pathogen that causes various diseases in economically important crop species including tomato. This fungus is separated into sub-groups known as anastomosis groups (AGs) based on hyphal anastomosis reactions between isolates. *Rhizoctonia solani* AG 4 causes damping-off of seedling and root and crown rot of tomato. The aim of this work was to identify the reaction of tomato genotypes to *R. solani* under controlled conditions. Reaction tests of 6 hybrid tomato cultivars were conducted with agar plate assay with *R. solani* AG 4 HG-I isolate A-E6R. Disease severity was evaluated, 8 days after inoculation using a scale of 0 to 4 (0 = healthy, no hypocotyl lesions; 4 = dead seedling and/or ungerminated seed). Results revealed significant differences between the disease severities of the tomato cultivars. Among the tomato cultivars used in the study, Şeker Kız had the lowest disease severity levels against *R. solani*

Keywords *Rhizoctonia solani*, tomato cultivars, resistance

1. Introduction

The tomato (*Solanum lycopersicum* L.) is a Solanaceae family member and one of the most widely cultivated vegetable crops worldwide, next to the potato. Tomatoes are consumed in several ways: fresh, mixed in other food items, or processed and canned as juice, sauce, salsa, paste, ketchup, soup, and pickle. Tomato is the richest source of various vitamins, minerals and supplies a sufficient amount of the antioxidant lycopene pigment that helps to protect the body against heart and cancer disease [1,2]. Tomatoes are an important vegetable crop in Türkiye, and the country ranks third in worldwide tomato output [3].

Nematodes, bacteria, viruses, and fungi cause a broad variety of tomato diseases that reduce tomato yields and quality. *Rhizoctonia solani* Kühn (teleomorph: *Thanatephorus cucumeris* (Frank) Donk.) is the most important soilborne fungal pathogen, which develops in both cultured and non-cultured soils, causing the symptoms of damping-off and seed and root rot diseases to a wide range of vegetable and crop plants, including tomatoes [4]. To date, *R. solani* is divided into 13 AGs designated as AG 1 through 13 and the bridging isolate (BI) group [5-8]. Several AGs, such as AG 4, are further subdivided into intraspecific groups based on cultural morphology, host specificity, temperature effect on growth, nutritional requirements, frequency of hyphal anastomosis, and pathogenicity [9]. Isolates of AGs 1, 2-1, 2-2, 3, 4 HG-I, 4 HG-II, 5, and 6, were recorded on tomatoes worldwide [10-15], including Türkiye [16-19].

Rhizoctonia solani control is extremely difficult because it lives in the soil, combines high saprophytic competitiveness with a wide host range, and also ensures long-term survival in soil by sclerotia production [20].

Several fungicides have been suggested for controlling *R. solani*; nevertheless, unconscious use of the fungicides poses health and environmental risks. Therefore, having access to genotypes that are resistant to moderate resistance may help to reduce the need for fungicides and can also play a significant role in an integrated disease management program that is successful. Among the recognized strategies for controlling plant diseases, using resistant cultivars is thought to be the most efficient and economical approach. In this framework, using resistant cultivars is a strategic approach to *Rhizoctonia solani* integrated management.
The present investigation was intended to identify the reaction of tomato cultivars against *R. solani* under controlled conditions.

2. Materials and Methods

Plant and fungal material

A set of six hybrid tomato cultivars (PTK 254, Sorti, Şeker Kız, Mariana, Gürcan, and Zahide) was used to evaluate resistance in this study. *Rhizoctonia solani* isolate A-E6R belonging to AG 4 HG-I used in this study was obtained from the Department of Agricultural Biotechnology, Faculty of Agriculture, Isparta University of Applied Sciences, Isparta, in Türkiye, which was previously isolated from soil samples from the rhizosphere of tomato plants in greenhouses in Antalya province of Türkiye's West Mediterranean Region. The pathogenic capability of the isolate of *R. solani* AG 4 HG-I used in this study was previously investigated by Eken et al. [21].

In vitro reaction tests

For *in vitro* experiments, the agar plate assay was carried out according to the method described by Eken et al. [21]. *Rhizoctonia solani* isolate A-E6R was transferred to potato dextrose agar (PDA) and cultured at 25ºC for 5 days, after which mycelial discs were taken out with a 5-mm-diameter cork borer from an actively growing edge of the fungal culture and transferred to 9-cm-diameter Petri plates containing 1.5% water agar medium (WA) and incubated for 2 days. Before use, tomato seeds were surface-disinfested by dipping in 2% NaOCl for 5 min and air-dried, then six seeds were put at equal distances around the fungal disk. Seeds were placed around the sterile PDA discs as a control treatment. Cultures were incubated under continuous darkness for 4 days at 25 ± 1ºC, after which they were placed on a laboratory bench under 12 h light and 12 h darkness. Tomato seedlings were scored for disease severity after 8 days of incubation using a scale of 0 to 4 (0 = healthy, no hypocotyl lesions; 4 = dead seedling and/or ungerminated seed) designed by Eken & Tuncer [18], with minor modifications. The following formula was used to convert the scale values to disease severity values [22]: disease severity (DS%) = [∑ (number of the seedlings at each scale × scale value)] x 100 / (Total seedling evaluated x highest scale value).

3. Data analysis

The pathogenicity tests were carried out in a completely randomized design with three replicates, and the experiments were carried out twice. The percentage data was log-transformed before the analysis of variance (ANOVA). Tukey's Honestly Significant Difference (HSD) test was used to separate means, with statistical significance assessed at $p \leq 0.05$. SPSS software version 16.0 Windows statistical program was used for statistical analyses.

4. Results & Discussion

Rhizoctonia solani AG 4 HG-I isolate A-E6R caused inhibition of seed germination and severe necrosis symptoms in the seedlings (Figure 1). The results are in agreement with the studies of Jiskani et al. [23], who confirmed isolates of AG-4 as the predominant damping-off on tomatoes. Results revealed significant differences between the disease severities of the tomato cultivars. None of the tested tomato cultivars had complete resistance to *R. solani*. Cultivar Şeker Kız had the lowest disease severity levels to *R. solani* AG 4 HG-I isolate A-E6R (Figure 2). Several researchers have screened the tomato genotypes and reported the differences in the reactions against *R. solani* and most of the tomato varieties are susceptible, while some of them do exhibit a moderate to high degree of disease tolerance [16,19, 24-27]. Yıldız and Döken [16] indicated that *R. solani* was very aggressive on different tomato cultivars, and of these cultivars, Sunny (6066 F1) had the

highest seedling emergence (95.6%) and the lowest disease rating (1.3). However, susceptible cultivars, such as Rio Fuego, Rio Grande, NDM 725, Konia, and Interpeel, did not emerge with any seedlings.

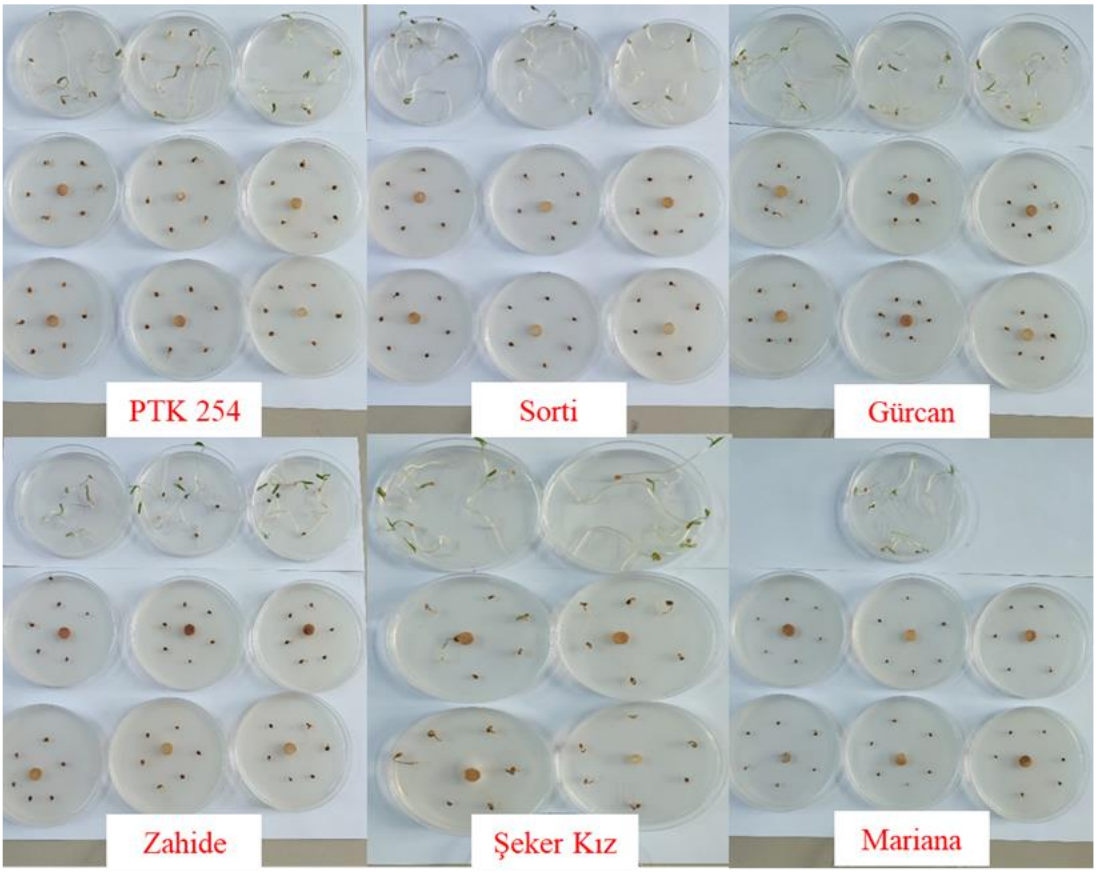

Figure 1: In vitro reaction tests of some tomato cultivars against Rhizoctonia solani AG 4 HG-I isolate A-E6R

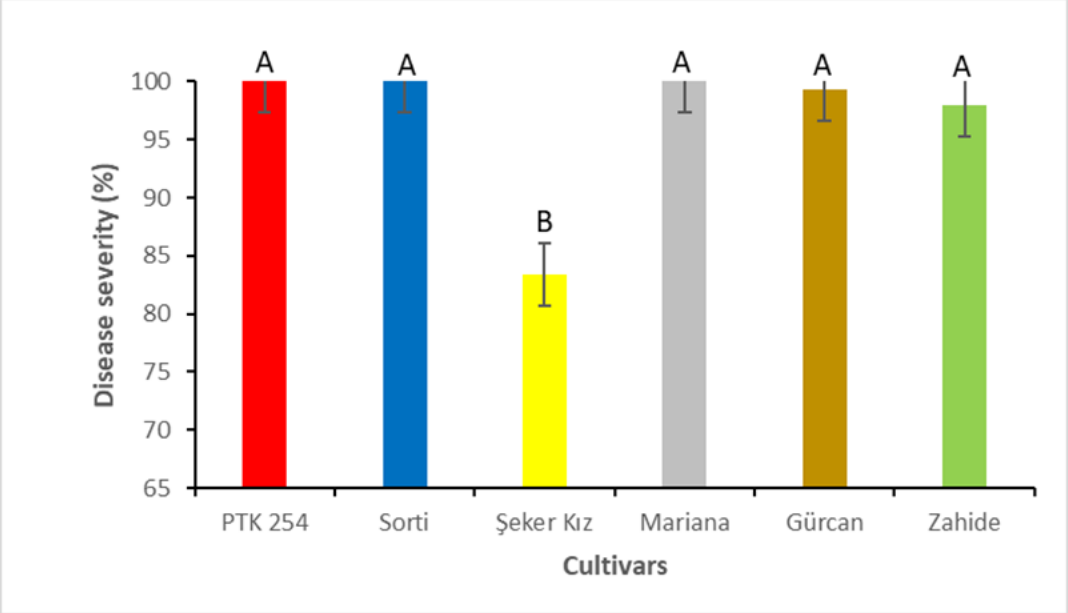

Figure 2: Reaction of tomato cultivars to Rhizoctonia solani AG 4 HG-I isolate A-E6R. According to Tukey's HSD test, mean values followed by the same letter are not differ significantly (P≤0.05).

5. Conclusion

Rhizoctonia solani management is extremely difficult because it lives in the soil and combines great saprophytic competitiveness with a broad host range. Resistance is a fundamental attribute of all living systems, and host plant resistance is the most efficient and eco-friendly means of disease management. These preliminary results suggest that there was variation among tomato cultivars in the *R. solani* AG 4 HG-I reaction and will be useful for further research to improve cultivar resistance against *Rhizoctonia*.

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