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PECTOLITIC ACTIVITY OF MOLD FUNGI OF THE *GENERA FUSARIUM* AND *TRICHODERMA*

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The aim of the present study was to investigate the pectolytic activity of fungi belonging to the genera *Fusarium* and *Trichoderma* isolated from soils of Azerbaijan.27 mold strains were isolated as pure cultures from the Talish agroclimatic region of Azerbaijan. 15 of the 27 studied strains belonged to 5 species of the genus *Fusarium (F. lactis, F. moniliforme, F. oxysporum* and *F. sublunatum*) whereas 12 strains belonged to 4 species of the genus *Trichoderma (T. lignorum, T. macrosporum, T, roseum* and *T.viride*). It was determined that all studied strains exhibited pectolytic activity.The pectin lysis zone ranged from 22 to 38 mm in *Trichoderma* strains, and from 5 to 8 mm in *Fusarium* strains. Thus, the pectolytic activity of the former was 1.2 to 7.6 times higher than that of the latter.*Trichoderma lignorium* BDU-C55, *T. viride* BDU-C49 and BDU-LK42 strains had the maximum pectolytic activity.

Keywords: pectolytic activity, pectin lysis, *Trichoderma, Fusarium*

INTRODUCTION

One of the most important issues facing humanity today is the efficient utilization of plant residues that are renewed annually. In nature, plant waste is decomposed and mineralized by microorganisms. Therefore, the efficient utilization of plant residues is possible only through microbial activity [2,10]. One of the structural components of plant tissues is pectin and related pectic substances. Pectin is a high-molecular-weight polysaccharide of the hexose type and is a component of the intercellular matrix and cell walls of higher and lower plants [6]. Apple pulp remaining after juice extraction may contain 25-35% pectin, and a certain proportion of pectin also remains in the juice itself. In this case, pectin gives turbidity to the juice and after a while a precipitate forms at the bottom of the juice. In such cases, pectin causes turbidity in the juice, and over time a precipitate forms at the bottom. Pectolytic enzymes are also used to improve the clarity of wine and beer. In addition, these enzymes are widely applied in the processing of linen[11]. On the other hand, pectolytic enzymes are also widely used to increase the juice yield from fruits [3,7,14]. Therefore, enzymes capable of degrading pectin are of considerable practical importance and are widely used in industry. It should be noted that pectolytic enzymes are commonly produced by microorganisms, particularly molds [8, 12,13]. Several enzymes belonging to a heterogeneous group are involved in pectin degradation [9]. Considering the industrial importance of these enzymes, the search for and selection of new efficient producers is of great practical significance.

The aim of the present study was to investigate the pectolytic activity of fungi belonging to the genera *Fusarium* and *Trichoderma* isolated from soils of Azerbaijan.

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MATERIALS AND METHODS

62 soil samples collected from the Talysh agro-climatic regions of Azerbaijan (Astara, Lankaran, Lerik, Masalli and Jalilabad). Suspensions were prepared from the samples and inoculated onto Czapek–Dox agar medium with the following composition (g/L): sucrose, 20.0; $NaNO_3$, 3.0; K_2HPO_4, 1.0; $MgSO_4 \cdot 7H_2O$, 0.5; KCl, 0.5; $FeSO_4 \cdot 7H_2O$, 0.001; and agar, 20.0; pH 6.0. The inoculated cultures were incubated at 28°C. After microscopic examination to confirm colony purity, the isolates were transferred onto fresh Czapek agar medium. In this way, 26 mold strains were obtained and stored under refrigeration as working cultures. The morphological and cultural characteristics of the purified strains were studied, and their genus and species identities were determined using available taxonomic keys [4]. To determine the initial pectolytic activity of the fungal strains, the isolates were inoculated onto agar medium of the same composition, in which beet pectin was used instead of sucrose, and incubated at 28°C for 72 h. The total pectolytic activity was determined based on the lysis zone formed in the pectin nutrient medium. The diameter of the lysis zone was measured using a ruler and expressed in mm [1].

All experiments were performed in 4 replicates and statistically processed [5]. A significance threshold of $p < 0.05$ was applied to ensure the reliability of the results

RESULTS AND DISCUSSION

27 mold strains were isolated as pure cultures i from the Talish agroclimatic region of Azerbaijan.Based on morphological and cultural characteristics, strains BDU-C57, BDU-L42, and BDU-M43 were identified as belonging to the species *Fusarium coeruleum*; strains BDU-A48, BDU-M42, and BDU-L35 were assigned to *Fusarium lactis*; strains BDU-C60, BDU-LK3, and BDU-M48 to *Fusarium moniliforme*; strains BDU-A42, BDU-L40, BDU-LK22, and BDU-C59 to *Fusarium oxysporum*; and strains BDU-LK14 and BDU-M29 to *Fusarium sublunatum*. Similarly, strains BDU-A24, BDU-C55, and BDU-M39 were identified as *Trichoderma lignorum*; strains BDU-A36, BDU-LK42, and BDU-C49 as *Trichoderma viride*; strains BDU-L26 and BDU-M35 as *Trichoderma macrosporum*; and strains BDU-A32, BDU-C62, BDU-L8, and BDU-LK9 as *Trichoderma roseum* (Table).Thus, 15 of the 27 studied strains belonged to 5 species of the genus *Fusarium*, whereas 12 strains belonged to 4 species of the genus *Trichoderma*.

The pectolytic activity of the fungal strains was determined by measuring the pectin lysis zones formed on agar medium. The obtained results are presented in Table. It was determined that all studied strains exhibited pectolytic activity. Based on the diameter of the pectin lysis zones, the fungal strains were divided into four groups. The first group included strains with lysis zones ranging from 32 to 38 mm. This group comprised *Trichoderma lignorum* BDU-A24, BDU-C55, and BDU-M39; *T. viride* BDU-LK42 and BDU-C49; and *T. roseum* BDU-C62. The second group consisted of strains with lysis zones ranging from 22 to 30 mm, including *T. roseum* BDU-A32 and BDU-LK9, *T. macrosporium* BDU-L26 and BDU-M35, and *T. viride* BDU-A36. The third group included strains with lysis zones ranging from 11 to 20 mm, namely *Fusarium moniliforme* BDU-LK31, *F. lactis* BDU-A48, BDU-M42, and BDU-L35, as well as *F. oxysporum* BDU-C59, BDU-A42, BDU-L40, and BDU-LK22. The fourth group consisted of strains with lysis zones ranging from 5 to 10 mm, including *Fusarium coeruleum* BDU-C57, BDU-L42, and BDU-M43; *F. moniliforme* BDU-C60 and BDU-M48; and *F. sublunatum* BDU-M29 and BDU-LK14.The pectolytic activity of the first was 1.1 – 1.7; 1.6 – 3.5 and 3.2 – 7.6 times higher than the pectolytic activity of the second, third and fourth, respectively. Likewise, the pectolytic activity of the second group was 1.1 – 2.7 and 2.2 – 4.4 times higher than that of the third and fourth groups, respectively. The pectolytic activity of the third group was 1.1 – 4.0 times higher than that of the fourth group (Table).It should be noted that the lysis zones of fungi belonging to the genus *Fusarium* ranged from 5 to 18 mm, whereas those of fungi belonging to the genus *Trichoderma* ranged from 22 to 38 mm.

Thus, the pectolytic activity of *Trichoderma* strains was 1.2–7.6 times higher than that of *Fusarium* strains. The highest pectolytic activity was observed in *Trichoderma lignorum* BDU-C55 and *T. viride* BDU-C49 and BDU-LK42 strains.

Table. Pectolytic activity of *Fusarium* and *Trichoderma*

Fungi		Pectolytic activity (lysis zone, mm)
Species	Strains	

Fusarium coeruleum	BDU-C57 BDU – L42 BDU –M43	7 ± 0,3 5 ± 0,2 6 ± 0,3
Fusarium lactis	BDU_A48 BDU – M42 BDU –L35	16 ± 0,5 14 ± 0,4 18 ± 0,5
Fusarium moniliforme	BDU-C60 BDU – LK31 BDU –M48	9 ± 0,4 11 ± 0,5 7 ± 0,3
Fusarium oxysporum	BDU –C59 BDU – A42 BDU-L40 BDU – LK22	12 ± 0,6 16 ± 0,6 14 ± 0,5 10 ± 0,4
Fusarium sublunatum	BDU-LK14 BDU –M29	10 ± 0,3 9 ± 0,4
Trichoderma lignorum	BDU- A24 BDU – C55 BDU –M39	32 ± 2,1 38 ± 2,0 34 ± 1,5
Trichoderma viride	BDU- A36 BDU – LK42 BDU –C49	24 ± 1,0 36 ± 2,0 38 ± 2,0
Trichoderma macrosporum	BDU – L26 BDU –M35	22 ± 1,0 25 ± 1,0
Trichoderma roseum	BDU-A32 BDU – L8 BDU –LK9 BDU – C62	20 ± 1,0 28 ± 2,0 30 ± 2,0 34 ± 2,5

Following these initial results, the activities of endopectinase and polygalacturonase enzymes of fungi showing high pectolytic activity will be investigated.

CONCLUSIONS

Thus, 27 mold strains were isolated as pure culture from the Talysh agroclimatic region of Azerbaijan. 15 strains were classified into 5 species of the genus *Fusarium*, and whereas 12 strains were classified into 4 species of the genus *Trichoderma*. It was determined that all studied strains exhibited pectolytic activity. However, the pectolytic activity of fungi of the genus *Trichoderma* was higher than that of fungi of the genus *Fusarium.Trichoderma lignorum* BDU-C55, *Trichoderna viride* BDU-C49 and BDU-LK42 were identified as the strains exhibiting the highest pectolytic activity. Following these preliminary results, the activities of endopectinase and polygalacturonase enzymes produced by fungi exhibiting high pectolytic activity will be investigated.

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