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PHYTOPATHOLOGICAL ASSESSMENT OF THE INFECTION OF GRAPE GENOTYPES WITH OIDIUM DISEASE IN A NATURAL BACKGROUND

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Abstract. In this study, phytopathological assessment of oidium infection of grape varieties and forms was carried out based on I.N. Naydenova evaluation method. In the Absheron Scientific-Research Base, a phytopathological assessment of oidium infection of 77 grape varieties and forms was carried out in the natural background. Cluster analysis was constructed according to the Euclidean distance index of the UPGMA method by using PAST statistical software package. The studied genotypes were grouped into 5 clusters according to their resistance. In the first cluster, 3 genotypes were highly resistant with 1-1,5 points of infection, in the second cluster 22 genotypes were high susceptible with 5 points of infection and in the third cluster there were 29 genotypes with 4-4,5 points of susceptible samples. The fourth cluster grouped 6 genotypes that showed resistance to oidium, which were selected as resistant genotypes with 2-2,5 points of infection. 17 genotypes were grouped in the last cluster of the dendrogram, which showed tolerant with 3-3.5 points of infection. At result of evaluation Ag Khalili, Arayatli gara uzum, Qara uzum are determined as high resistant forms.

Keywords: *Grapevine, Uncinula necator, genotype, resistant.*

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1. Introduction

The grapevine (*Vitis vinifera* L.) stands as one of the significant plants widely distributed in diverse climate zones across the globe, thriving in warm and dry as well as relatively cold regions. The most favorable climatic zones for grape cultivation are considered to be the shores of the Caspian Sea and the Black Sea, California and South Africa. Notably, Azerbaijan holds the distinction of being one of the ancient centers of origin and formation for the grapevine, making our country a land of viticulture and winemaking. Viticulture in Azerbaijan has held special importance among agricultural sectors since ancient times, concurrently carrying a broad industrial character (Panahov, 2010; Shkhlinski, 2016).

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Throughout history, our people have utilized the grapevine for various purposes, including the production of household and industrial products, as well as the development of various sectors of national agriculture for decorative purposes (Salimov, 2009).

The enrichment of grapevine varieties in vineyards, the replacement of less productive and lower-quality grape varieties with better ones, the efficient utilization of the genetic reserves of grapes and the increase in the production of grapes and its processed products are of great importance. To ensure the comprehensive development of viticulture in our country, attention should be directed towards two main directions. The first is the expansion of vineyard areas and the promotion of small-scale viticulture, and the second is the development of new varieties that meet modern standards both domestically and in the global market, while remaining cost-effective and competitive. Considering all these factors, there is a growing demand for grape varieties in the direction of table grapes and wine that require minimal expenses for disease and pest control, preserve the quality of grapes for an extended period and meet modern technological requirements (Panahov, 2010; Shkhlinski, 2014).

According to recent studies, it has been determined that approximately 600 local and introduced grape varieties have been cultivated in the territory of Azerbaijan, with around 400 of them being native grape varieties. However, similar to many parts of the world, our country is also facing challenges related to the genetic erosion and deterioration of the grape genepool due to various negative factors. In Azerbaijan, valuable grape varieties have already been lost and a significant number of them are under the threat of extinction. Approximately 75 grape varieties have been lost and up to 80 varieties are at risk of extinction (Panahov, 2010).

The damage inflicted on agricultural crops by phytopathogenic organisms is excessively high. As a result of the impact of diseases and pests, crop losses account for 34.9%, with 11.6% attributed to damage caused by diseases (Shkhlinski, 2014).

In the framework of integrated pest management measures, continuous development of plant varieties resistant to diseases and pests using the immunoselection method, implementation of agro-technical measures and use of the least harmful chemical preparations against diseases and pests are considered. Grapevines are severely affected by phylloxera and major fungal diseases (powdery mildew, downy mildew, gray rot and anthracnose), with crop losses reaching 50% or more during severe disease outbreaks (Panahov, 2010; Shkhlinski, 2019).

The primary fungal diseases challenging viticulture worldwide are false mildew (*Plasmopara viticola*) and powdery mildew (*Erysiphe necator* syn. *Uncinula necator*). After downy mildew, the most dreaded disease of the grapevine is powdery mildew. The causative agent of powdery mildew has two stages: the conidial stage, known as *Oidium tuckeri* Berk and the resting stage, called *Uncinula necator* Burrill. Sometimes, this disease is referred to as powdery mildew or ash. Powdery mildew affects all green organs of grapevines throughout the vegetation period, damaging shoots, leaves, flower clusters, and tendrils. A characteristic external sign of this disease is the ash-colored or sometimes brownish powdery layer covering the affected organs. The development of powdery mildew, which poses a potential threat to grape yields, varies depending on weather conditions. Its pathogens proliferate at the end of summer and rapidly develop during autumn, affecting grape clusters (Shkhlinski, 2014; 2007).

In the early stages of infection, flowers and young shoots dry up. Some heavily affected grapevines emit a fishy odor. In some regions of Azerbaijan, this disease is sometimes referred to as "tozvurma" or "sibrə" (dust).

During the assessment, continuous and tolerant forms are selected from the sampled specimens and they are utilized in intravarietal and intervarietal crosses to obtain new grape varieties resistant to diseases and pests. For the purpose of creating grape varieties resistant to powdery mildew, crossing was carried out between *V.vinifera* L. and *V.amurensis* Rupr. species and for the first time in breeding practice, the mildew resistance gene Pv (a) was identified as being derived from the *V.amurensis* Rupr. species.

2. Materials and methods

The phytopathological assessment of grapevine leaf and shoot susceptibility to powdery mildew was evaluated based on the methods of I.N.Naydenova (Shkhlinski *et al*., 2019):

0 points: Immune – no disease observed on leaves. Conidia germinate, but the mycelium cannot form haustoria and quickly perishes.

1 point: Highly resistant – necrotic spots appear on leaves affected by the disease. Conidia germinate and the mycelium formed is weak. The disease affects individual leaves on the vine.

2 points: Resistant – small, bright mycelial spots appear on leaves affected by the disease and the leaves take on a lighter color.

3 points: Tolerant – non-confluent oval-shaped spots appear on leaves affected by the disease. Despite good development of the mycelium, the spots do not merge, but conidia can develop normally. Several leaves affected by the disease are found on the vine.

4 points: Susceptible – leaves affected by the disease are completely covered with mycelium and a large number of conidia develop. However, areas on the leaf petiole remain uninfected. The majority of leaves on the vine are affected by the disease.

5 points: Highly susceptible – leaves affected by the disease are entirely covered with a white-gray coating. Almost all leaves on the vine are infected and eventually shed. These scoring criteria were used to evaluate the susceptibility of grapevine varieties and forms to powdery mildew.

Phytopathological evaluation of natural occurrence of powdery mildew in grapevine shoots:

0. points - No damage observed in the shoots.
1. point - Very weak damage occurs, meaning damage is up to 5%.
2. points - Shoots are lightly affected, meaning damage is from 5% to 10%.
3. points - Shoots are moderately affected, meaning damage is from 10% to 25%.
4. points - Shoots are strongly affected, meaning damage is from 25% to 50%.
5. points - Shoots are very strongly affected, meaning damage is from 50% to 100%.

3. Results and discussion

A phytopathological assessment of 77 grape varieties and forms in the natural environment was conducted at the Absheron Scientific Research Base, focusing on the main powdery mildew disease. Due to the location of the Absheron Scientific Research Base on the Absheron Peninsula, favorable conditions for the severe development of powdery mildew, especially in summer and early autumn, are created in connection with the warm and dry weather prevailing in the region.

Table 1. The results of the phytopathological assessment of powdery mildew infections

Powdery Mildew Severity Ratings	Persistence, with a rating	leaf	shoot
Immune	0	0	0
High resistant	1-1,5	3	3
Resistant	2-2,5	6	6
Tolerant	3-3,5	17	17
Susceptible	4-4,5	29	29
High susceptible	5	22	22
Sum.:	-	77	77

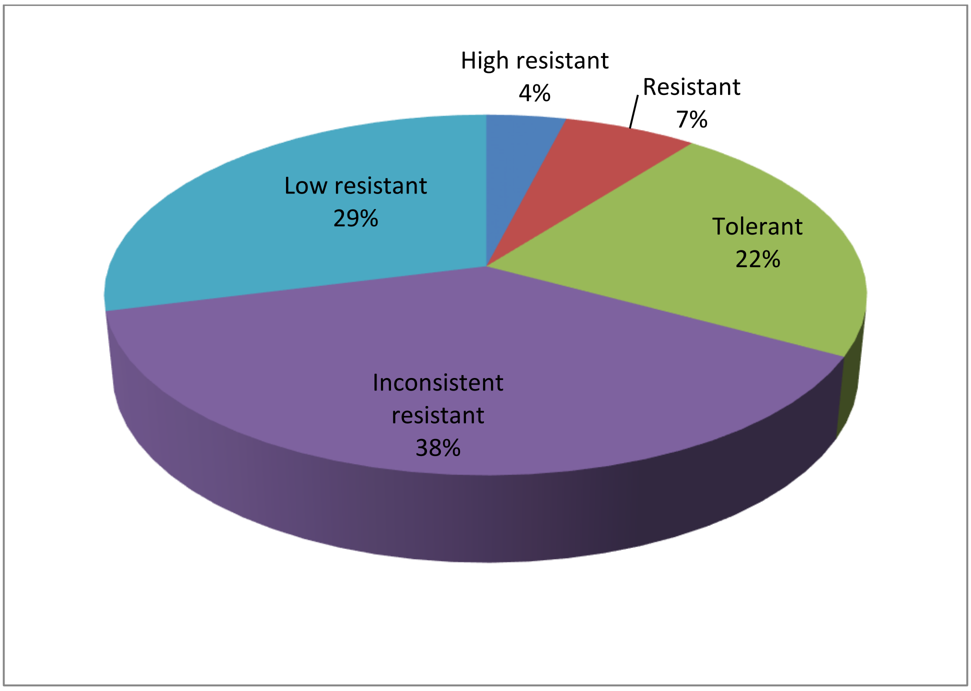


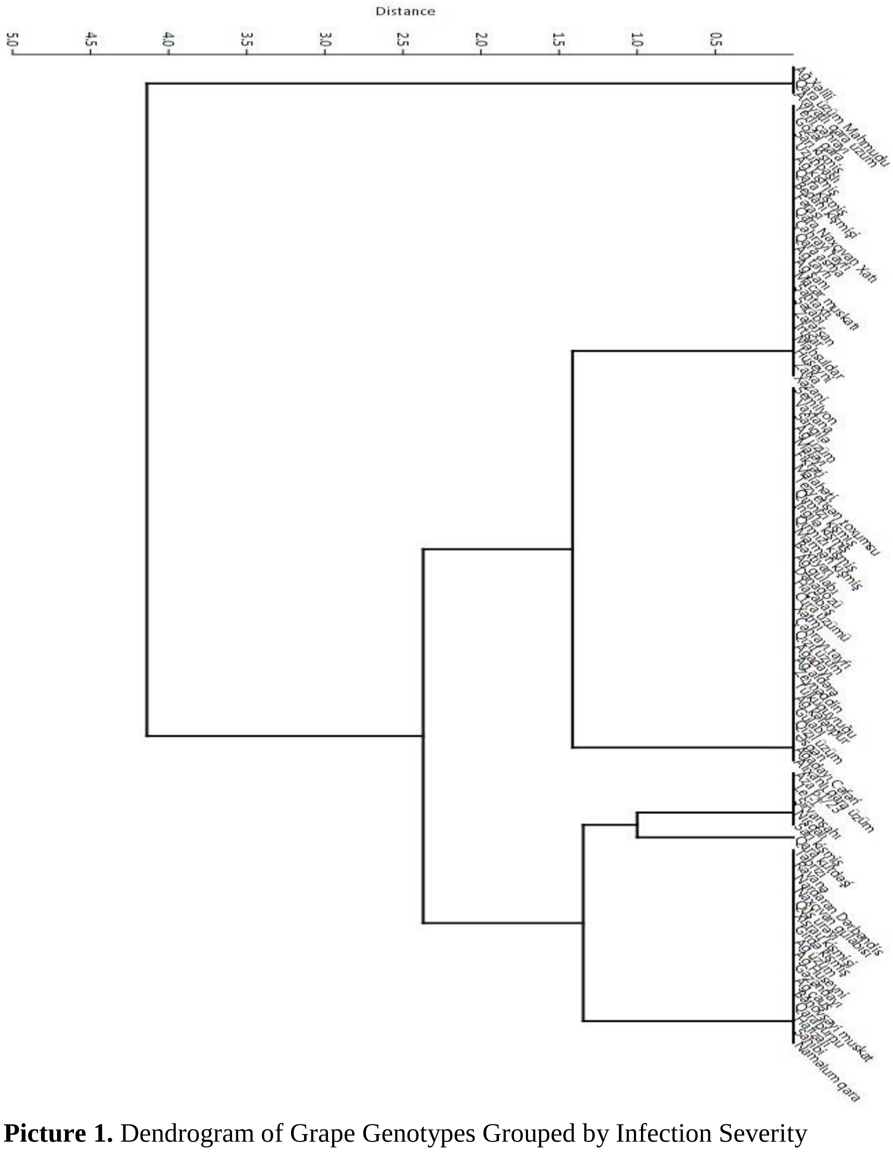
Table 2. Results of Phytopathological Assessment of Powdery Mildew, Percentage-wise

A research study evaluating the natural resistance to powdery mildew in leaves and shoots resulted in the categorization of 3 varieties as highly resistant with scores between 1-1.5, 6 varieties as resistant with scores between 2-2.5, 17 varieties as tolerant with scores between 3-3.5, 29 varieties as susceptible with scores between 4-4.5 and 22 varieties as highly susceptible with a score of 5. As seen from the diagram, the research determined that, in the natural environment, 4% of the varieties were highly resistant, 7% were resistant, 22% were tolerant, 38% were susceptible and 29% were highly susceptible to powdery mildew in leaves and shoots.

Cluster analysis: Cluster analysis has been performed using the UPGMA method of the PAST statistical software package based on the Euclidean distance index. This analysis allows us to visually observe the grouping of genotypes. Since the genotypes under investigation are grouped into 5 clusters based on resistance to powdery mildew, the dendrogram will be analyzed by dividing it into 5 clusters accordingly (Figure 1).

In the first cluster of the dendrogram, 3 genotypes are grouped, which are rated as highly resistant samples with a 1-1.5 score for infection. In the second cluster of the dendrogram, 22 genotypes are grouped. These genotypes have become highly susceptible with a 5 score for infection. In the third cluster of the dendrogram, 29 genotypes are grouped, which have become susceptible samples with a 4-4.5 score for infection. The fourth cluster of the dendrogram has grouped 6 genotypes that have shown resistance to powdery mildew. These genotypes have been selected as resistant genotypes with a 2-2.5 score for infection. In the last fifth cluster of the dendrogram, 17 genotypes are grouped and these samples have shown tolerance with a 3-3.5 score for infection.

At result of evaluation Ag Khalili, Arayatli gara uzum, Qara uzum are determined as high resistant forms.



Picture 1. Dendrogram of Grape Genotypes Grouped by Infection Severity

4. Conclusion

The results of the conducted research have determined the phytopathological assessment of oidium infection in 77 grape varieties. During the evaluation, continuous and tolerant forms were selected from the samples taken and by using them in intra- and inter-varietal crosses, new grape varieties resistant to oidium disease can be obtained.

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