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IMPACT OF STILBENOIDS ON PROPAGATION OF POWDERY MILDEW (*Uncinula Necator*) ON THE GRAPE BERRIES UNDER LAB AND VINEYARD CONDITIONS

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ABSTRACT

It is established impact of vine phytoalexin stilbenoids on propagation of powdery mildew (*Uncinula necator*) under lab and in vineyard conditions. In experiment are used Georgian red and white grape varieties. In concrete: Rkatsiteli(white) from a 40year old vineyeard cultivated in Telavi district; tsitska (white) from a 12year old vineyeard cultivated in Mtsketa district; Saperavi (red) from a15years old vineyard cultivated in Gurjaani district. In natural conditions experiment was held on Rkatsiteli and Saperavi grapes varieties In east Georgia. In experiment were used following stilbenoids: trans-resveratrol, trans-e-viniferin and total stenbenoids obtained from vines. It has been established their inhibitory effect on the propagation of *Uncinula necator*. Under lab it is investigated phytoalexin stilbenoids 100% biological affectivity: pre-treated grapes with freshly made water suspension of 5 mg/100ml (total stilbenoids praparation, trans-e-viniferine and trabs-resveratrol) completely(100%) inhibited *Uncinula necator*. In vineyard same total stilbenoids preparation showed less biological effect in test on Rkatsiteli and Saperavi grapes. It is determined for rkatsiteli grapes variety biological efficiency in the range of 80.00% -84.62% and for saperavi 83.33%-86.67 % range. This result is lower compared to the effectiveness of Bordeaux mixture. It ranges from 96.66% to 100% for Saperavi. The results of the study are scientific novelties for above mentioned grapes variety and it is important to establish a correlation between their immunity and phytoalexin stilbenoids.

Key words: vine; stilbenoids; powdery mildew; Biological efficiency

INTRODUCTION

Stilbenoids are a group of phenolic compounds represented by the monomeric stylbene -resveratrol and its polymeric and glycosides derivatives. Due to the variety of high biological activity of stilbenoids, their research is a topical issue in vines and grapes. Functional purpose of moderately consumed red wine in terms of treatment and prophylaxis together with other phenolic compounds, it is significantly due to the antioxidant and other activity of wine stilbenoids [1-6]. The study of Georgian wine and grape varieties stilbenoids and some of their biological activities correspond to this direction. Specifically, identification of trans-resveratrol, trans-ε-viniferin and two tetrameric stilbens, including hopiphenol, from Rkatsiteli vine [7]. Determination of trans-resveratrol and trans-ε-viniferine in Georgian red grape varieties and different types of wines [8-10]; Identification of resveratrol glycosides cis- and trans-piceides, astringin and astringinin (piceatannol), group of miyabenols in saperavi (red) grape variety [11-14]. Determining the stimulating effect of some stilbenoids on the activity of wine yeasts in alcoholic fermentation of grape juice [16]; Also, the non-inhibitory effect of stilbenoids on lactic acid bacteria in malolactic fermentation of red wine [15]; Among biological activities of stilbenoids, their phytoalexin properties are one of the important issue for the plant. The phytoalexin activities of vine stilbenoids have been confirmed by several studies [17-20]. We have studied the phitoalexin activities of stilbenoids of Georgian white- and red grape varieties under bacterial and fungal diseases. From bacterial diseases has been studied a bacterial cancer of the vine. It has been identified the major stress metabolite phytoalexin stilbenoids and it was established their inhibitory action on the cancer-causing bacterium Agrobacterium tumefaciens [21-24]. It has been identified sress- metabolite stilbenoids based on the study of samples naturally infected Georgian wine grape varieties with fungal diseases. From fungal diseases have been studied Downy mildew (Plasmopara viticola), Powdery mildew (*Uncinula necator*) and Gray mildew (*Botrytis cinerea*). It was established the inhibitory effect of phitoalexin stilbenoids on fungal disease-caused by microorganisms. [25-29]. As continued the studies of the phytoalexin characteristic of the vine stilbenoids, the further aim was to test the results obtained in the lab under natural conditions- in the vineyard.

The aim of the study was to determine the biological efficiency of vine stilbenoids on the propagation of powdery mildew – *Uncinula necator* on the skin of white and red wine grapes in laboratory and natural conditions - in the vineyard.

OBJECTS AND METHODS

Object: As research objects we used white and red wine grapes varieties harvested in Eastern Georgia. For laboratory experiment we used Rkatsiteli (white) from a 40-year-old vineyard cultivated in Telavi district; Tsitska (white) from a 12 years old vineyard cultivated in Mtskheta district; Saperavi (red) from a 15-year-old vineyard cultivated in Gurjaani district. In natural conditions - in the vineyard we conducted an experiment on Rkatsiteli and Saperavi grapes in the mentioned vineyards in Eastern Georgia.

Experiment in Lab. From them we made water suspensions of vine stilbenoids in the concentrations indicated in the tables. We took Saperavi, Rkatsiteli and Tsitska grapes found in the vineyard, infected with naturally powdery mildew. We then prepared from them a water conidium suspensions. For the laboratory experiment, we took 15-15 grains of healthy grapes, soaked in water suspension of stilbenoid preparation, and placed them in petri dishes in a damp filter paper. Then sprayed powdery mildew water suspension and covered. Closed petri dishes were stored in the laboratory. In the control version, we applied the water conidium suspension of powdery mildew to healthy grapes soaked in water.

The vineyard experiment. We selected 3-3 clusters of Rkatsiteli and Saperavi vines with different number of clusters. We conducted an experiment on pesticide-free vines. The characteristics of the experiment variants are given in the **Table 1**.

The biological efficacy of stylbenoids tested in laboratory and vineyard conditions was determined by the appropriate method [30]. Individual stilbenoids and stilbenoids total preparation were isolated from the vine with ethil acetate and received fraction was separated in column with adsorbent "Sephadex G50".

Table 1: Experiments variants

Variant	Grape clusters quantity for Saperavi Rkatsiteli	Infection characteristic
1. control	Vine 1- 14 9 Vine 2- 23 17 Vine 3- 34 27	Spraying water on healthy clusters and then spraying Powdery mildew water spore suspension
2. Experiment -I	Vine 1- 15 9 Vine 2- 24 18 Vine 3- 32 26	Spraying stilbenoids water suspension(5mg/100ml) on healthy clusters and then spraying Powdery mildew water spore suspension
3. Experiment-II	Vine 1- 13 8 Vine 2- 22 16 Vine 3- 33 28	After spraying Sulfur containing Bordeaux mixture and then spraying Powdery mildew water spore suspension

RESULTS AND DISCUSSIONS

Table 1: Propagation of powdery mildew on rkatsiteli grape buries under the lab conditions

##	Experiment variants	Buries in petry dishes	Buries infected powdery mildew	Powdery mildew propagation, %	Bioogical efficiency, %
1	P-1.0 mg/100ml	15	2	13.0	84.9
2	P-3.0 mg/100ml	15	1	6.6	92.3
3	P-5.0 mg/100ml	15	0/1	0/6.6	*100/92.3
4	V-1 mg/100ml	15	3	20.0	77.7
5	V-3 mg/100ml	15	2	13.0	84.9
6	V-5 mg/100ml	15	0/1	0/6.6	*100/92.3
7	R-1mg/100ml	15	3	20.0	77.7
8	R-3 mg/100ml	15	2	13.0	84.9
9	R-5 mg/100ml	15	0/1	0/6.6	*100/92.3
10	Control	15	12	80.0	

- R – trans-resveratrol;
- V – trans-έ-viniferin;
- P - Stilbenoids total preparation
- Fraction counter- Freshli made suspension;
- Fraction denominator-1 week suspension;

Table 2: Propagation of powdery mildew on tsitska grape buries under the lab conditions

##	Experiment variants	Buries in petry dishes	Buries infected powdery mildew	Powdery mildew propagation, %	Bioogical efficiency, %
1	P-1.0mg/100ml	15	3	20.0	77.7
2	P-3.0mg/100ml	15	2	13.0	84.9
3	P-5.0mg/100ml	15	0/1	0/6.6	*100/92.3
4	V-1 mg/100ml	15	4	26.6	62.2
5	V-3 mg/100ml	15	3	20.0	77.7
6	V-5 mg/100ml	15	0/1	0/6.6	*100/92.3
7	R-1mg/100ml	15	2	13.0	84.9
8	R-2 mg/100ml	15	1	6.6	92.3
9	R-3 mg/100ml	15	0/1	0/6.6	*100/92.3
10	Control	15	13	86.6	

table 3. Propagation of powdery mildew on saperavi grape buries under the lab conditions

##	Experiment variants	Buries in petry dishes	Buries infected powdery mildew	Powdery mildew propagation, %	Bioogical efficiency, %
1	P-1.0 mg/100ml	15	2		
2	P-3.0 mg/100ml	15	2	13.0	84.9
3	P-5.0 mg/100ml	15	0/1	0/6.6	*100/92.3
4	V-1 mg/100ml	15	3	20.0	77.7
5	V-3 mg/100ml	15	2	13.0	84.9
6	V-5 mg/100ml	15	0/1	0/6.6	*100/92.3
7	R-1mg/100ml	15	3	20.0	77.7
8	R-3 mg/100ml	15	2	13.0	84.9
9	R-5 mg/100ml	15	0/1	0/6.6	*100/92.3
10	Control	15	11	73.3	

Table 4: Impact of stilbenoids total preparation on Powdery mildew(*Uncinula necator*) propagation on Saperavi grape cluster in vineyard

Experiment variant	Number of clusters on vine	Infected clusters	Infection propagation,%	Biological efficiency of the preparation,%
Control	Vine 1- 14	10	71.43	
	Vine 2- 23	18	78.26	
	Vine 3- 34	26	76.47	
Pre-treatment 1	Vine 1- 15	2	13.33	86.67
	Vine 2- 24	4	16.67	83.33
	Vine 3- 32	5	15.62	84.38
Pre-treatment 2	Vine 1- 13	0	0	100
	Vine 2- 22	1	4.55	95.45
	Vine 3- 30	1	3.33	96.66

Table 5: Impact of stilbenoids total preparation on Powdery mildew(*Uncinula necator*) propagation on Rkatsiteli grape cluster in vineyard

Experiment variant	cluster on vine	Infected clusters	Infection propagation,%	Biological efficiency of the preparation,%
Control	Vine 1-9	7	77.77	
	Vine 2-17	13	76.47	
	Vine 3-27	21	77.77	
Pre-treatment 1	Vine 1-10	2	20.00	80.00
	Vine 2-18	3	16.67	83.33
	Vine 3-26	4	15.38	84.62
Pre-treatment 2	Vine 1-13	1	7.69	92.31
	Vine 2-18 Vine 3-21	1	5.55	94.45
		1	4.76	95.24

The results of the experiment in the laboratory indicate the inhibitory effect of the phytoalexin stilbenoids on the activity of Powdery mildew propagation infected by *Uncinula necator*. Inhibition activity is expressed by the intensity of fungal spread and development and the biological effectiveness of the stilbenoids. It was established dependent of Powdery mildew propagation intensity on the stilbenoids concentration on Rkatsiteli, Tsitska and Saperavi grapes berries. The increasing concentration of stilbenoid in water suspension leads to an increasing inhibitory effect of the fungus spore suspension. At the same time, it was indicated that, individual and total stilbenoids preparation in water suspensions lost significant activity within 1 week after preparing and have reduced inhibitory-biological efficacy against *Uncinula necator*. In control variant (unprocessed with stilbenoids) on all three experimental grape varieties skins Powdery mildew developed 100%. The experiment variants showed 100% biological efficacy of freshly made 5% stilbenoids total preparation water suspension. Also, it was fixed inhibitory impact of trans-e-viniferin and trans-resveratrol of their concentrations **(Table 1-3)**. The propagation of Powdery mildew on the skin of Saperavi and Rkatsiteli grapes was found to be different in laboratory

and vineyard conditions. This applies to control options as well: 100% biological effectivity of the water suspension of the total preparation of stilbenoids under lab when irrigated berries with water spore suspension of *Uncinula necator*, changed in the vineyard at intervals:for Rkatsiteli 80.00%-84.62%; for Saperavi 83.33%-86.67%. The effectiveness of the stilbenoids total preparation against Powdery mildew in vineyard conditions was found to be significantly lower than the efficiency of sulfur-containing Bordeaux mixture. It ranged in interval: for Rkatsiteli 92.31%-95.24%; for Saperavi 95.45%-100% (Table 4,5).

CONCLUSION

It was established inhibitory effect of phytoalexin stilbenoids on the Powdery mildew infection caused by *Uncinula necator* activitiy. This action was reflected in the intensity of disease propagation and therefore was assessed by the biological efficiancy of stlibenoids. A difference was found between the results obtained under lab and vineyard conditions. In particular, the biological efficiency of stilbenoids against spreading of disease under laboratory conditions for Rkatsiteli and Saperavi far exceeds the efficiency observed under vineyard conditions. The results obtained, together with the results of our previous research, are an important basis for determining the correlation of vine immunity with phytoalexin stilbenoids in fungal disease conditions.

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