

# СЕЛЬСКОХОЗЯЙСТВЕННЫЕ НАУКИ

## THE IMPACT OF EXOGENIC METHIONINE ON THE VINE GRAPE PLANTS RESISTANCE TO PHYLLOXERA DAMAGE

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**Abstract.** The present paper is concerned with the study of exogenic amino acid methionine impact on the resistance of the own-rooted plants of Bianca vine grape to phylloxera damage. The preparation improves the resistance of the vine grape plants to phylloxera damage, inhibits its access to the source of nourishment. It permits to boost the yield of vine grape and improve its quality.

**Key words:** vine grape, methionine, phylloxera, chlorogenic acid, lignin, yield, quality

**Introduction.** Phylloxera is an extremely dangerous vermin of vine grape. It results in the death of root system in the great number of vine grape varieties, particularly cultivated in the own-rooted culture in connection with the development of secondary pathological process, caused by the phytopathogenic microorganisms [1, 2]. The promising direction to lower the phylloxera and phytopathogens damage to *V. vinifera* species plants may be the application of the elicitor-type biologically active substances, improving the resistance of plants because of immunization effect. Not without interest as inducers of defense reactions is application of the low-molecular immunomodulating compounds, the analogues of natural substances, increasing the resistance of plants to the phytopathogens damage and triggering in a plant the mechanisms of immunization [3, 4]. The specific selection of such compounds and their use in the dosage friendly for a plant permits to achieve the effect of immunization thanks to activation of the metabolic processes, aimed at the detoxication of exogenic compound, that is a way to make the plants more resistant to the damage.

The targeted change of the separate elements of metabolic activity in the plants permits to create the environment unfavourable for phylloxera feeding [4-6]. Of the utmost interest is the use of methionine amino acid – ethylene precursor – a stress hormone of the plants. The impact of abiogenic methionine on the metabolic processes permits to optimize the biochemical composition of cytosol within the framework of the more complete realization of genetic potential, to reduce dramatically the damage of *V. vinifera* plants, both phytopathogens and phylloxera [7-9].

The objective of this paper is to study the impact of amino acid methionine on the biochemical parameters of *Vitis Vinifera* plants resistance to phylloxera damage.

**Materials and methods.** In 2013 - 2014 the own-rooted plants of Bianca vine grape variety, planted in 2005, were treated by methionine in the small-plot experiments in the vineyard, located in the Private Corporation “Primorskoye” in Primorsky settlement of Temryuksky district of Krasnodar Territory. Pruning of vines is a unilateral high-trunked cordon [10]. The treatment of the vine grape plants was carried out on June 6, July 3, July 30 by the water solutions of preparation through the use of CHAMPION PS 257 shoulder sprayer. The consumption of fluid was 1000 l/ha. No background processings by the fungicides were carried out. The plants untreated by the preparations were taken as a control, as a reference material the plants, treated by the BASF produced Fastak KE pyrethroid in 360 g/ha dosage were used. Experimental design: 1. – Control, 2. – Fastak, KE – 0. 36 l/ha - reference material, 3.– Methionine 10 g/ha. The replication of experiments was quadruple. In each replication there were 5 vines. The vines planting pattern was 4.0 x 2.5 m. In 2014 the variants were arranged on the same plants, as it was in 2013. The contents of chlorogenic acid, glycine, proline, abscisic acid and calcium cations in the vine grape leaves was determined by the capillary electrophoresis method on Kapel 105 M instrument, the contents of lignin in the roots – by the weight method [11, 12].

**Results and discussion.** To reveal the physiological-biochemical regularities of methionine and Fastak pyrethroid influence on *Vitis Vinifera* species’ resistance to the phylloxera root-form damage, the optimum parameters of the most significant physiological-biochemical criteria (contents of lignin in the roots, chlorogenic acid in the leaves and roots of vine grape) (Table 1) were established for the vine grape plants for the first time.

**Table 1 – The parameters of phylloxera damage, chlorogenic acid contents in the leaves and roots and lignin in the vine grape roots, 2013 -2014**

Variant of experiment	Phylloxera damage		Contents of chlorogenic acid, mg/g		Contents of lignin, %
	leaves, %	pcs./100 roots	leaves	roots	roots
Control	17-18	15-17	0.13-0.19	17.4-52.6	2.06-13.7
Fastak	0	13-15	0.16-0.26	19.2-19.3	2.81-14.2
Methionine	0	4-5	0.23-0.28	2.6-36.5	18.91-24.0

The highest content of chlorogenic acid in the roots of the vine grape plants – lignin precursor in the leaves and lignin – was established to be noticed in the variant which employs methionine. The higher contents of chlorogenic acid in the roots is noticed in the variants control, and with the use of Fastak. The higher contents of chlorogenic acid in the leaves and lignin – in the roots of vine grape create the conditions unfavourable for their damage both by leaf and root form of phylloxera. It is confirmed by the results of determining the leaf-form phylloxera colonization of the young leaves of the vine grape lateral shoots and roots damage by the phylloxera root form.

In the variants with Fastak preparations and methionine no colonization of the young leaves of lateral

shoots was observed. The number of the root-form phylloxera damages of the roots per 100 absorbing roots of more than 1 mm in diameter proved to be the highest one for the control variant and that with Fastak preparation. In the variant with the use of methionine the damages numbered less, as compared with a control 3.4 – 3.75 times.

The metabolome estimation of the vine grape plants resistance to phylloxera root form allowed to establish it to result from the higher in-the-leaves content of glycine aminoacid, making part of GRP-proteins and proline – making part of PRP-proteins – the special structural proteins, strengthening the cell walls under the influence of pathogene (Table 2).

**Table 2 – The parameters of contents of proline and glycine, abscisic acid and Ca<sup>2+</sup> cations in the leaves of the Bianca vine grape plants (2013-2014)**

Variant of experiment	Contents of proline, mg/kg	Contents of glycine, mg/kg	Contents of abscisic acid, mg/kg	Contents of Ca <sup>2+</sup> , mg/kg
Control	68.9-82.7	2.9-5.6	1.4-1.6	0.28-0.97
Fastak	52.0-87.8	8.2-12.1	0.8-4.2	0.33-0.94
Methionine	132.3-119.1	0.5-6.7	2.9-3.0	0.45-0.85

Under the influence of stress factors (biologically active substances, pathogens, etc.) in cytosol of the cells the content of Ca<sup>2+</sup> and abscisic acid, activating the cascades of protective metabolic reactions [13], grows. Methionine and Fastak increase the content of Ca<sup>2+</sup> and abscisic acid in the leaves of Bianca vine grape plants. It was established that the best results of Vitis Vinivera resistance to the root-form phylloxera

damage (damage of roots – 0 points, in a control – 4 points) and those of resistance to the phytopathogens damage (Alternaria damage 0 % and Yeast – 5 %, Penicillium - 5 %) were achieved through the use of Methionine treatment of the vine grape plants.

The abiotic elicitors made a positive impact on production process and, as a consequence, on the yield of Bianca vine grape (Tables 3, 4).

**Table 3 – The influence of Fastak and methionine preparations on formation of Bianca vine grape productivity, Private Corporation “Primorskoye”, 2013-2014**

Variant	Surface of shoot leaves, sq.cm	Number of bunches, pcs./shoot	Surface of leaves, sq.cm/bunch
Control	1740.1-2094.1	1.8-1.9	966.7-1102.1
Fastak	1406.4-1970.8	1.7-1.9	1037.3-1097.9
Methionine	2149.9-2632.2	1.9-2.1	1121.5-1385.4

**Table 4 – The influence of Fastak and methionine preparations on the yield and quality of Bianca vine grape Private Corporation “Primorskoye”, 2013-2014**

Variant of experiment	Weight of bunch, g	Yield per vine, kg	Sugar content of berries juice, g/100cub.cm	Titrate acidity of juice, g/cub.dm
Control	51-103	2.06-3.48	21.1-22.0	8.3-9.6
Fastak	52-128	2.26-3.62	17.3-24.1	7.3-8.4
Methionine	55-138	2.62-3.86	21.9-22.5	8.7-9.6

Methionine, as distinguished from Fastak, boosts the surface of the shoot leaves (by 23.6-25.7% against a control), inclusive of that falling on the bunch of grapes (16.0-25.7 % against a control).

The preparation of methionine contributed to formation of the larger surface of leaf area by the vine grape plants, permitting to secure the higher yield, that was higher by 10.9-27.2 percent, as compared with a control. The sugar-acid index in methionine variants was 2.52 -2.34, 2.54 -2.29 in the control and in Fastak variant – 2.37-2.87. Consequently, the preparations did not lower the quality of grapes.

Consequently, methionine aminoacid and Fastak pyrethroid increase the yield of vine grape in connection with the higher resistance to phylloxera damage, increase in the surface of photosynthetic area and the better development of root system, as compared with a control. The methionine preparation is not inferior to Fastak preparation by its efficiency, that is preconditioned by the higher resistance of plants of the Bianca own-rooted variety vine grape to the damage by leaf- and root-form phylloxera.

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