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Effect of Cu and Co nanoparticles based complex on stratification of grape grafts

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Grafting and further development of grafted components in grapes depends on a complex set of internal, external factors and on the conditions that are created as a result of the mutual influence of the components being grafted [1]. In recent years, a large number of new complex products has appeared. They were developed based on growth regulators (phytohormones) of cytokinin and auxin nature with high physiological activity [2, 3]. Therefore, a problem of testing and detection of the most effective methods and compositions containing physiologically-active substances, including nanoparticles, that promote for grafting and further development of grafted grapevines is relevant.

A research object was the vines of technical grape varieties Rkatsiteli, Levokumsky and RipariaCh rupestris 101-14 stock.

It is known fact that copper activates certain enzymatic systems, participating in a composition of enzyme molecules or increases resistance to stress factors by their activation. According to the researches, the physiologically grounded concentration of a working solution of biogenic metal nanoparticles makes 1-10 mg/l [4]. The copper nanoparticles were obtained by electron beam vapor-phase deposition of metal and alkali metal halide (NaCl) [5]. Further, compositions of growth regulators of natural origin and synthetic analogs of phytohormones were created based on these nanoparticles, an average copper particle diameter is 2-2.5 nm in 1.0 mg / L and 2.0 mg/l concentrations.

The sections of stock and graft in the place of their connection were soaked in 60% glucose solution containing nanoparticles and growth regulator compositions for 5 minutes for activation and acceleration of callus cells formation process and then stock and grafted vines were connected. Besides, a plaster in form of copper foil was used for some of the cuttings. It was also produced by electron-beam

deposition [6], had 4 × 10 size with regular porous structure, saturated by the same composition. This plaster was inserted in a butt between the stock and the graft. The reference samples were the stalks only treated with 60% glucose solution. Sprouting was carried out at 24-26°C temperature in the plastic containers of 0.5 l capacity filled with sand.

This method of graft treatment significantly accelerated formation of the callus in the places of graft and stock connection, at that the size of the main shoot in the graft and the number of formed roots increased. Use of copper nanoparticles at 1.0 mg/l concentration in the grafting place slightly increases the amount of callus being formed, by 23% in the Levokumsky variety, 7.5% in shoot length and 8% in the roots, and if concentration of copper nanoparticles makes 2,0 mg/l, amount of callus increased by 17%, length of shoot by 10%, and number of roots by 11%.

Combination of the nanoparticles (concentration 1.0 mg/l) in the composition content with 2.5 mg/l concentration provides for rise of size of the main shoot by 16.25%, callus weight by 24.3% and number of roots by 18%, and at 2.0 mg/l copper nanoparticle concentration the size of the main shoot grew by 17.5%, callus mass by 32.85% and number of roots by 36.4%.

Application of copper nanoparticle based composition for direct processing of the cuting and its additional infiltration from porous foil (plaster) had the most positive effect on root formation process, which increased by 63-72%.

It should be noted, that all treated stalks had 100% rooting, and that in the reference group of Levokumsky variety made 72%. Obtained positive biological indices allows recommending such type of treatment for grape grafting.

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