allowed us to identify current trends in ensuring economic security in the digital economy.

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DIAGNOSIS OF HARMFUL VIRUSES OF STONE FRUIT CROPS BY ELISA AND PCR METHODS

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Abstract: *The presence of phytopathogenic viruses is an important factor in cultivation of fruit and berry crops, affecting the yield and development of plants. Infected plantations are more susceptible to fungal and bacterial diseases and in combination cause significant economic damage to farms. Production of virus-free planting material is a priority for plant seedling producers and requires improvement and establishment of norms for diagnostics of phytopathogenic viruses.*

Keywords: *stone fruit crops, PCR, ELISA.*

In recent years, the number of rhizosphere parasitic nematodes, including nematodes - vectors of viral, fungal and bacterial infections, has increased sharply in natural biocenoses, and the infestation of viral and fungal infections and a number of other phytophages has increased accordingly, which is associated not only with the weakening of phytosanitary and quarantine control in natural phytocenoses, but also due to the absence of mowing of weeds in natural meadows and abandoned fields, orchards and berry fields overgrown with small woods and abandoned land use, absence of aerial and ground treatments with broad-spectrum pesticides and systematic (preventive) felling of diseased trees in forest biocenoses [1].

Among the symptoms caused by viruses are various kinds of mosaics and mottling. In some cases, leaves are completely chlorotic, as is characteristic of so-called jaundice. There are also symptoms such as thickening of infected leaves, dwarfism, and curling of leaves. Thickening of veins and whitening or lightening of veins are sometimes observed. Symptomatology may be similar to deficiency or excess of nutritional elements, violation of agrotechnique, negative abiotic factors, therefore, laboratory diagnosis of phytopathogenic viruses should be carried out when symptoms are detected [2].

The production of healthy planting material requires methods to identify the economically important plant viruses. Successful diagnosis is a key factor at the plant certification stage and includes testing by enzyme immunoassay and polymerase chain reaction methods. For highly sensitive diagnosis of phytopathogens of viral nature, molecular-genetic (based on the determination of the specific sequence of phytopathogen nucleic acid) and serological (based on the interaction of highly specific antibodies with phytopathogens) methods of analysis are the most widely used [3].

The main methods of identification of phytopathogenic viruses are as follows:

The ELISA method is based on the strict specificity of interactions between antigen and antibody and enzymatic reactions leading to a change in the color of the reaction mixture. This method is suitable for mass testing of plants and allows for automation of most of the analysis steps.

Unfortunately, at the moment, diagnostics by enzyme immunoassay is difficult due to the fact that diagnostic kits are mostly supplied from European countries. For this reason, it is expedient to develop a test system in Russia for the diagnosis of viruses in berry crops that will work comprehensively.

The PCR method is a molecular biology method that allows to create copies of a certain DNA fragment (after the reverse transcription reaction of viral RNA) from the original sample, increasing its content in the sample by several orders of magnitude.

During the study, a test tube with the sample is placed in special conditions, under the influence of which nucleic acid molecules (double-stranded DNA synthesized from single-stranded RNA) encoding the genetic information of a certain pathogen are repeatedly copied. If there are even a small number of pathogenic

particles in the sample, then in a few hours their number will increase to tens or even hundreds of millions.

The main difficulty in PCR is the isolation of RNA from the leaves of stone fruit crops. The result of PCR largely depends on the efficient extraction of high-quality nucleic acid preparations. Standard extraction methods, including phenol and chloroform, were not always successful in eliminating the negative influence of phenolic compounds and polysaccharides, which led to the inhibition of Taq-polymerase and adversely affected the amplification process [4].

One method of visual diagnosis is the use of indicator plants. When infected, indicator plants react with distinct symptoms. Indicator plants are inoculated with the sap of the plant under investigation, then grown in greenhouses and observed if the symptoms are manifestated [5]. This method is time-consuming and requires special cultivation conditions, so it is not suitable for rapid, highly sensitive determination of phytopathogens, but it is widely used in the cultivation of virus cultures for further purification and immunoglobulin production.

The most common phytopathogens of stone fruit crops are *PPV* (plum pox virus), *ACLSV* (apple chlorotic leaf spot virus), *PDV* (prunus dwarf virus), *PNRSV* (prunus necrotic ring spot virus), and *CLRV* (cherry leaf roll virus). These viruses cause chlorotic spots, necrosis, deterioration of fruit appearance, and varietal qualities in plants. In testing of stone fruit plants, the highest prevalence of *PNRSV* and *PPV* viruses was observed [6]. Also, according to [7], in the European part of Russia, in the period from 2007 to 2022, plants of stone fruit crops were tested, and the highest prevalence was registered among *PNRSV* (11.9%) and *PPV* (14.9%). *ACLSV*, *PDV* and *CLRV* viruses generally had low prevalence or false positives.

Thus, the prospects of controlling the phytosanitary condition of orchard crop plantations are determined by the availability and possibility of identifying the virological status of plants with the help of various diagnostic methods. Regular monitoring of plantations will improve the phytosanitary condition of orchards and, consequently, reduce cultivation costs.

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EINFLUSS VON PFLANZENWACHSTUMSREGULATOREN UND MIKRODÜNGER AUF DIE GESETZMÄßIGKEITEN DER Cd-TRANSLOKATION IN ERDBEERPFLANZEN (*FRAGARIA x ANANASSA* DUCH.)

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Zusammenfassung: *In einem Vegetationsversuch wurde der Einfluss von Blattbehandlungen von Erdbeerpflanzen der Sorten Honey, Troitskaya, Red Gauntlet mit den Wachstumsregulatoren Epin-Extra, Emistim C und Blattdüngung mit Mikrodünger Silaktiv auf die Gesetzmäßigkeiten der Cd-Translokation in Früchten und Blättern mit Bodenkontamination mit Schwermetallen (SM) in Höhe von ungefähr zulässiger Konzentration UZK = 1 untersucht.*

Schlüsselwörter: *Erdbeeren, Pflanzenwachstumsregulatoren Epin-Extra, Emistim C, Silaktiv-Mikrodünger, Cd-Translokation.*

Schwermetalle (SM) sind häufige Umweltschadstoffe. Sie sind biologisch toxisch und können lange Zeit im Boden verbleiben. SM werden von Pflanzen aktiv aus dem Boden aufgenommen und von den Wurzeln zu anderen Organen und Früchten transportiert. Die Kontamination mit Schwermetallen stellt eine ernsthafte