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**Efficiency of diagnostics of virus diseases of tomatoes**

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## **Efficiency of diagnostics of viral diseases of tomatoes.**

Diagnosis of viral diseases of tomatoes and the establishment of a variety of viruses circulating in Ukraine and infect *Lycopersicon esculentum*. Methods. Visual diagnosis, immunoassay and transmitted electron microscopy. Results Data are given on the detection of some plant virus infections of common tomato (*Lycopersicon esculentum* Mill.). Infected tomato plants are 3.1 to 22% of the experimental specimens and vary according to the type of virus and region of the research. Conclusions The presence of Tobamovirus (RMMoV, TomVV), Cucumovirus (CMV), Tobravirus (TRV) and Carlavirus (PVM-to) antigens, which infect common tomato, has been established. The most commonly found in the research were tomato mosaic virus and M-potato virus (tomato isolate).

*Key words: viral diseases, Tobamovirus, Cucumovirus, Tobravirus, Carlavirus, Tomato.*

Diseases of plants are considered as one of the agents that hinder the development of the rural economy. Caused diseases are virtually uncontrollable, reduce yields and cause significant economic losses to agriculture [9]. Plants of *Lycopersicon esculentum* infect many viruses, the most damaging of which are: a cucumber mosaic virus, a tomato aspermya virus, a tomato mosaic virus, a non-virus of circular spotting of tomatoes, a non-virus of ring spots of tobacco, a spot spotting virus of tomatoes, a mosaic virus of pepino [1, 10 ], X, -M- and Y-potato viruses [4]. Today, in the culture of *Lycopersicon esculentum*, new viruses are becoming widespread, including the yellow curvature virus of the tomato rootworm, Torado tomato virus, and the pepino mosaic virus [11]. The purpose of the research is to establish the diversity of viruses circulating in the territory of Ukraine and infect *Lycopersicon esculentum*. Research methodology. The objects of research were *Lycopersicon esculentum* plants with virus-like symptoms, selected from agroecenoids in different regions of Ukraine. Method Key words: viral diseases, Tobamovirus, Cucumovirus, Tobravirus, Carlavirus, Tomato. Identification and selection of plant material for external symptoms is the simplest and most widespread. It is based on the ability of many viruses to cause plants to exhibit the symptoms of lesions that appear in the form of strips on leaflets, deformation of leaf blades, shortening of stems and shoots, changes in leaf coloration, appearance of necrotic stains on leaves, etc. For research, samples of common tomato plants with typical viral symptoms from the Kyiv, Poltava, Zhytomyr, Vinnytsia, Chernihiv oblasts and Crimea were sampled. To detect viral antigens, an enzyme-linked enzyme-linked immunosorbent assay (ELISA) was used to modify the sandwich with Loewe test systems (Germany). It was carried out in 96-well Polystyrene Labsystem labels in accordance with the recommendations of the manufacturer of test systems. Vegetative samples (vegetative organs and fruit plants) for IFSA were prepared by homogenizing the infected plant material in 0.1 M phosphate-salt buffer + 0.001M EDTA in a ratio of 1: 2 followed by centrifugation at 4000 rpm during 20 min at a temperature of 4 ° C at a centrifuge PC-6. The resulting homogenate was used for immunoassay analysis. The samples were analyzed for the presence of antigens of viruses: a cucumber mosaic virus; Mosaic tomato virus; Tuteunum mosaic virus; Tobacco virus; Virus ring spots of tomatoes; Virus of weak spotty pepper; The yellow curvature viruses of the tomato virus. The results were recorded on the Thermo Labsystems Opsi MR (USA) with the Dynex

Revelation Quicklink software for wavelengths of 405/630 nm [7]. The morphology of the virions was investigated using Jeogs electron microscopes (JEM 1400, JEM-1230) using 2% uranyl acetate and phosphotungstic acid as a contrast agent [8].

Research results. On plants of the Solanaceae family (tomatoes, peppers and bacon), the symptoms of the disease were observed in 1 - 1,5 months. After sowing, during budding. The first signs of the disease were found on young leaves in the form of yellowish spots and tissue clarification along the main veins. Later on, plants developed symptoms of yellow or green systemic mosaic, there appeared chlorosis and spot necrosis. During the examination of the plant, various symptoms of leaflets and fruits occurred. On fluted plates, different types of mosaics were observed by color (light green and yellow-green) and placement (lining and interlayer mosaics), twisting sheets up the "shuttle", also noted chlorosis, filament and deformation (see Fig. Fig. A - e on the cover). There was no bronchial coloring of the leaves characteristic of the spot spotting virus. Yellow stains of irregular shape or rings were observed on the fruit. Symptoms found on plants were similar to those caused by viruses affecting vegetable crops. These viruses include the cucumber mosaic virus, tobacco strain virus, tomato mosaic virus, tobacco mosaic virus, ring sprayer virus, tomato ring spray virus, and many others. The similarity of symptoms on plants does not make it possible to clearly identify the type of virus, therefore further research was aimed at establishing the type of viruses using additional methods. An IFA modification of the sandwich with test systems in Loewe (Germany) identified the antigens of 8 viruses in selected *L. esculentum* specimens. The analysis of the obtained ELISA results determined the percentage of lesions of *L. esculentum* viral agents in terms of the total number of all samples taken in the experiment (Fig. 1). We have identified the presence of antigens of five viruses: the cucumber mosaic virus; Tomato mosaic virus; Tobacco strain virus, weak-spotted virus of pepper and M-virus of potatoes. In the Poltava region, 14.3% of the samples of common tomatoes are affected by the Tom virus, 22% - by MVK. In Zhitomir oblast, 7.1% of the experimental specimens of *Lycopersicon esculentum* are affected by the PMMoV virus. In the Kiev region, 7.1% of the samples of common tomato were also affected by this virus, 7.1% of samples of plants - the TRV virus, and 21.5% of samples of common tomato plants were contacted by the SMV virus. In Vinnytsia region tomato mosaic virus infected 14.3% samples of common tomato plants. In the Autonomous Republic of Crimea, 21.4% of samples of common tomato plants are affected by the Tom virus. The least affected were in the Chernihiv region. - all contaminated by the virus MVK-something 3.1%. This is confirmed by the pattern of the spread of viruses, ie, the decrease in their distribution in the northern regions of Ukraine [3].

Fig. 1. Percentage of samples *L. esculentum* affected families of viruses Tobamovirus, Cucumovirus, Tobravirus in different regions of Ukraine: - cucumber mosaic virus; - mosaic virus tomato; - a virus of weak period of pepper; - Tobacco virus; - M-potato virus

The method of electron microscopy was used for the direct detection of viruses in samples of *Lycopersicon esculentum*, determination of morphology, localization and size of virions. The results of ELISA were confirmed by the method of electron microscopy. During the electron microscopic examination, shear virions measuring  $300 \pm 3 \times 19 \pm 3$  nm were found, which, according to literature data, is characteristic of viruses of the Tobamovirus genus (Fig. 2). In addition, spherical viruses with a diameter of 29 nm were visualized. According to ELISA, they are identified as a cucumber mosaic virus, which according to literature data [11] is characteristic of viruses of the genus Cucumovirus (Fig. 3). The method of transmission electron microscopy revealed that the size of the detected viruses in the leaves of tomatoes of the Variety region is  $610 \pm 25 \times 12.5$  nm (Fig. 4). The IFA method also determined that tomatoes of the Balada variety were infected with MVK (tomato isolate). The M-virus of the potato belongs to the genus Carlavirus of the family Betaflexiviridae. By morphology, virions of MVK are filament-shaped, with an average length of 650 nm and a diameter of 12 nm. That is, the virus found on tomato and varietal regions of the region was identified as the Carlavirus genus. Similar results for the MVK virus infection in Ukraine were obtained by the authors [4]. Virus MVK on tomato plants is also found in Russia [12] and China [6]. Studies have shown that *Lycopersicon esculentum* plants are infected with ToMV, PMMoV, CMV, TRV and MVK viruses, which is confirmed by the results of ELISA and EM. The results of electron microscopic studies confirm the data of the immunofluorescence analysis and focus on further research on the development and improvement of the means of protection of tomato plants from viral infections [2]. Diagnosis of common edible tomato viruses is

an important step in the technology of growing ecologically safe vegetable production. After all, the use of chemical compounds is not always effective and safe, because the virus is localized in plant cells [5].

Fig. 2. An electron of the virus of the genus Tobamovirus

Fig. 3. Electrogram of cucumber mosaic virus

Fig. 4. Electrogram of filamentous virions found in foxes

#### Conclusions

According to the results of ELISA, the presence of Tobamovirus (RMMoV, TomVV), Cucumovirus (CMV), Tobravirus (TRV) and Carlavirus (PVM-to) antigens was determined. In the course of the study of viral diseases *L. esculentum*, the mono-infection was most common. Tomato mosaic virus and M-potato virus (tomato isolate) were the most widespread in the research. One of the most effective ways to fight viruses in tomatoes is to destroy weeds in the field and in the surrounding areas. All agrotechnical methods of cultivating the culture should be adhered to at the appropriate level, which will reduce the viral (infectious) load on plants and increase the production of environmentally safe tomato production.

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