crops in Ukraine. The detection of five emerging virus diseases – ZYMV, CABYV, INSV, TuMVand PMMV – can be partially attributed to the activation and spread of their respective insect vectors. From the other side, elevated air temperatures and humidity, absence of natural counterparts and other factors favor massive multiplication of the pests in greenhouse conditions. Vector-assisted transmission is highly efficient for these viruses and hence major efforts must be exerted on the controlling of insect vectors via various insecticides. Issues underlining the necessity of improvement of phytosanitary measures must also be raised.

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EFFECT OF LOW TEMPERATURE AND EXOGENOUS HYDROGEN PEROXIDE ON THE REACTION OF WHEAT, INFECTED VIRUS

В данной статье было исследовано влияние экзогенного пероксида водорода, низких положительных и отрицательных температур на растения озимой пшеницы. Иммуномодулирующие воздействие абиотических факторов на растение-хозяина при вирусной инфекции детектировали на основе оценки перекисного окисления липидов, по содержанию малонового диальдегида, реакции роста и ELISA. Обнаруженные соотношение может быть полезно для прогнозирования эпифитотии, вызванные изменением погодных условий, и для разработки экологически безопасных систем защиты сельскохозяйственных культур.

The effect of exogenous hydrogen peroxide, low positive and negative temperature on the plants of winter wheat, inoculated with the streak mosaic virus, were investigated. Immune-modulation effect of abiotic factors on plant-host of viral infection was detected based on the assessment of lipid peroxidation according to malon dialdehyde content, growth responses, ELISA. The discovered ratio may be useful for predicting epiphytotics caused by weather changing and the development of environmentally safe protection system in crops.

Wheat streak mosaic virus (WSMV) is one of the most important for monitoring agrocenoses in Ukraine. The discovered dependence between the symptoms, physiological, biochemical reactions and the crop capacity of the infected plants which underwent the differences in air temperature may serve as the indirect diagnostic criterion [6, 7]. Primary non-specific plant response to biotic stress as well as the stress of not biotic origin is associated with lipid peroxidation (LPO), which intensity is measured, in particular, according to the contents of malon dialdehyde (MDA). In the process of lipid peroxidation the endogenous hydrogen peroxide (HP, H_2O_2) is produced. It plays an important indicating role in expressing the stability genes. Exogenous H_2O_2 is used to study the early responses of plants to stress and as an immune modulator [2, 4]. The investigation of relationships of stress reactions of virus infected plants may become part of ecosystem monitoring.

The aim of our work is to identify the relationship between primary and secondary reactions of WSMV – infected wheat plants to hypothermia and exogenous hydrogen peroxide.

Materials and methods. For this winter wheat "Pamyat'" was grown in controlled conditions. Three days seedlings were soaked in 100 mm H_2O_2 solution and subjected to high temperature tempering (TT) 4 degrees C. The duration of action in both cases was 1 hour. Two-weeks plants were mechanically inoculated by WSMV, some of them were kept for 15 min. in a refrigerator at the temperature damage (TD) – (- 3) degrees C. The MDA content was determined based on the reaction of 2-tiobarbiturova acid [1, 8] separately in the leaves and roots. The content of MDA was determined twice: 1 day after exposure to abiotic factors and at the end of the experiment (13 days plants), 14 days after infection (27 days plants). At the same time the growth response and antigen content of WSMV were estimated by enzyme immunoassay analysis (ELISA).

Results and discussion. Analysis of the primary reactions of plants at 1 day after exposure to both abiotic factors and WSMV showed that the level of MDA in leaves of wheat decreased compared with controls, after exposure to the virus and hypothermia that could temper the plants – by 54% (fig. 1).

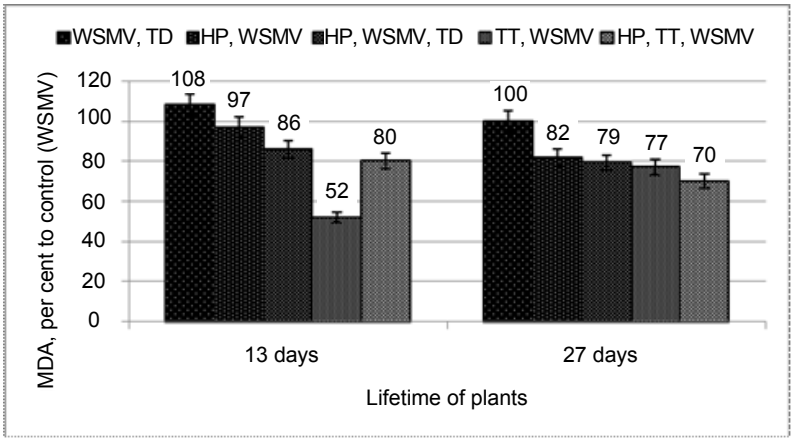

Fig.1. Changes of PLO (MDA content, in % to control: WSMV) in the winter wheat plants in dynamic of infection process ($p<0.05$)

In 10 days after exposure to abiotic factors MDA level came to normal. Two weeks after infection there was the increase in MDA level, which corresponded to increased concentrations of antigens WSMV (correlation coefficient 0.74): under the influence of the only biotic factor or in combination with negative temperature – by 22-84% (fig. 2).

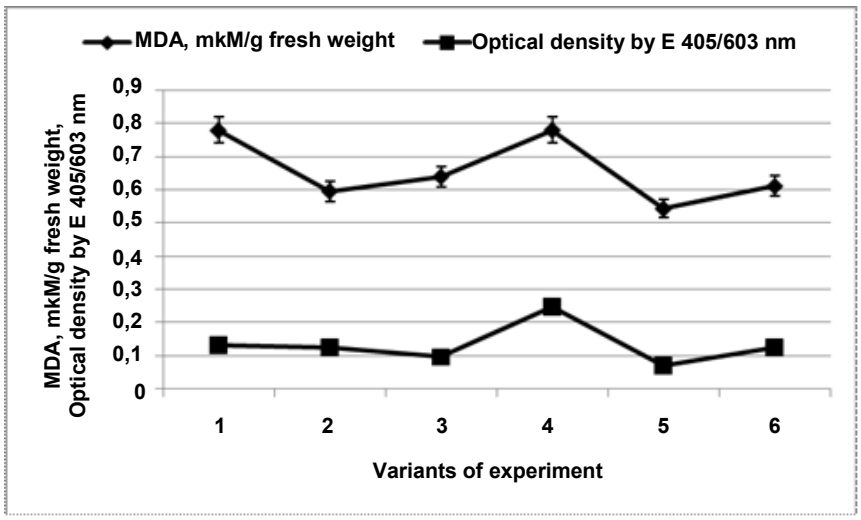

Fig.2. A directcorrelationbetweenLPO (MDAcontent, mkM/gfreshweight); and results of ELISAinleaves of 27 days winter wheat plants (optical density E 405/603 nm). Correlation coefficient r = 0.74, p<0.05

In infected plants, previously treated with peroxide or hardened with low positive temperatures, the intensity of lipid peroxidation was not significantly different from control. An inverse relationship between morphological metrics and the results of the ELISA was found (correlation coefficient -0.89) (fig.3)

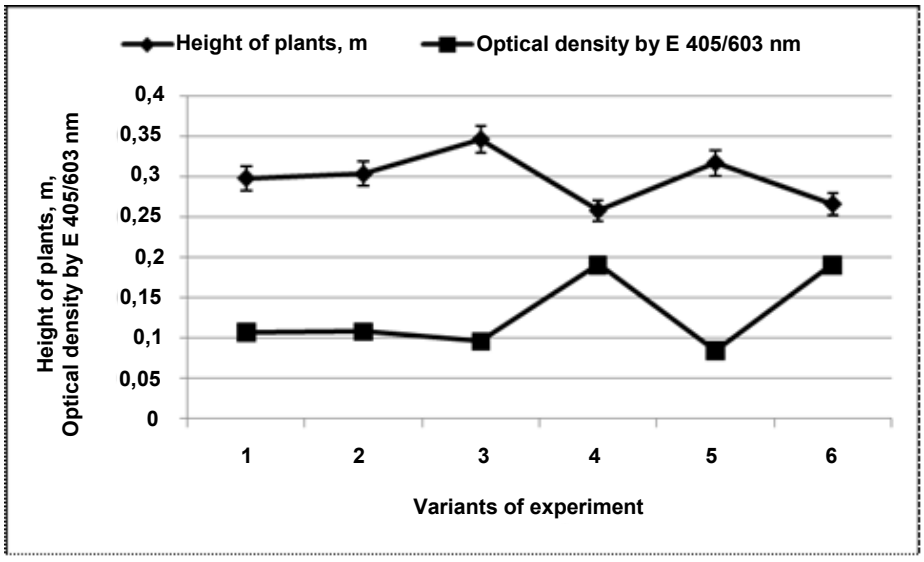

Fig.3. An inverse relationship between morphological metrics in 27 days plants and the results of the ELISA in 27 days plants roots was found (correlation coefficient r = -0.89), p<0.05

Revealed changes may indicate the development of immune reactions associated with antioxidant defense system of infected plants, pre-hardened with low positive temperature or treated with exogenous hydrogen peroxide. Our results and conclusions are coordinating with scientific sources [2–5].

Conclusion. The results can be used in ecosystem monitoring for predicting the probability of infection due to weather conditions and to develop safe methods of plant protection against pathogens of cereals.

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