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## CARLAVIRUS IN LILY COLLECTION OF GRISHKO' NATIONAL BOTANICAL GARDEN

Screening of *Lilium* plants on virus diseases in the collections of M.M. Grishko' National Botanical Garden have been conducted. Basing on serological, biological and morphological properties, we suggest that filamentous virus is related to Lily symptomless virus. Another virus is not completely identified, but symptoms induced on indicator plants suggested that it was Tomato aspermy virus.

**Key words:** lily virus, virus of ornamental plants.

**Introduction.** The genus *Lilium* is one of the most valuable commercial market flower bulbs in the world, mainly owing to its ornamental function as a cut flower or as a potted plant. Susceptibility of lilies to infectious diseases limits their popularity as ornamental plants. Fungi and bacteria are removed during the establishment of in vitro cultures from standard sterilization of bulb scales, whereas viruses are not [1].

Virus diseases of lily are of great significance because even when present in the latent state, the viruses could be transmitted to healthy plants and cause commercial losses [2]. In spite of the fact that we could predominantly diagnose virus infection basing on specific symptoms such as ring spot, mosaic and necrotic lesions, the identification of the pathogen is not possible. Sometimes lilies do not manifest signs of virus infection [3]. Besides, some factors such as disbalance of mineral nutrition, non-compliance with the light regime, invasion by insects and mites, infections caused by bacteria, mycoplasmas and fungus, or genetic disorders could lead to symptoms similar to those of virus nature. This involves necessity for serological diagnostics of the collections for preservation of their commercial value.

**Materials and methods.** *Lilium* plants with visual virus-like symptoms from greenhouse collections of M.M. Grishko' National Botanical Garden (Kyiv) were the objects of this research.

Infectious nature of disorders was confirmed proved using indicators plants typical for viruses normally infecting lilies such as *Cucumis sativus*, *Cucurbita pepo*, *Nicotiana tabacum* cv. Samsun, *N. Rustica*, *Lycopersicon esculentum*, *Phaseolus vulgaris*. Virus identification was carried out using TAS- and indirect ELISA [4]. Same staining samples were analyzed in electron microscopy at 30,000 magnification.

**Results and discussion.** Virus diseases are easily spread with planting material in vegetatively-propagated crops, including various ornamentals. Several viruses have been reported to occur wildly in lily plants, often as a mixed infection, reducing their vigour and sometimes their marketability [5].

Screening of *Lilium* plants for viral diseases in the collections of M.M. Grishko' National Botanical Garden was conducted. Different virus-like symptoms were detected on lily plants: mottling, mosaic, color breaking and leaf deformation. Infectious nature of disorders was confirmed using indicator plants typical for viruses normally infecting lilies (fig.1).

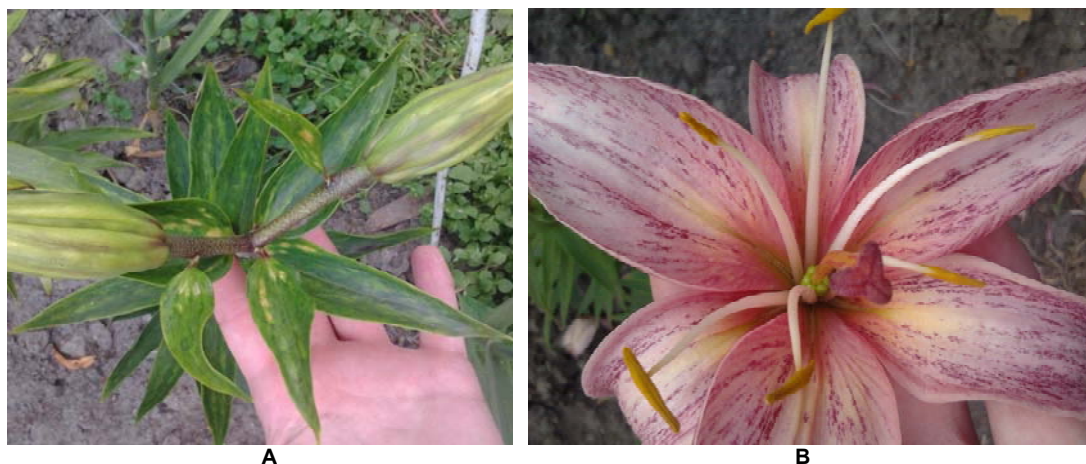


Fig.1. Virus-like symptoms on lily cultivars: 'H-Dawn' (A), 'Krema-2' (B)

To define biological properties of the pathogens, we conducted a bioassay using 6 species of indicator plants. Indicator plants were inoculated with sap obtained from lilies demonstrating virus-like symptoms. Results of the assay are presented on Table 1.

Table 1. Response of indicator plants inoculated with sap from symptomatic lily plants

Plant species	Symptoms on indicator plants					
	<i>Nicotiana tabacum</i> cv 'Samsun'	<i>Nicotiana rustica</i>	<i>Cucumis sativus</i>	<i>Lycopersicon esculentum</i>	<i>Cucurbita pepo</i>	<i>Phaseolus vulgaris</i>
Red Alert	N	-	-	-	-	-
Black Beauty	-	-	M	-	-	-
Sunburst	-	-	-	-	-	-
Krema-1	-	-	-	-	-	-
Royal Gold	-	N	M	-	M	M
H-Dawn	-	N	M, D	-	M	M, N
Krema-2	-	-	M	-	-	-
Mister Cas	-	-	-	-	-	-

-- negative response; M – mosaic; N – necroses, D-deformation

Mosaic symptoms on *Phaseolus vulgaris* inoculated with sap from lily cultivars H-Dawn' and Royal Gold are not typical for any known lily virus. On the contrary, mosaic symptoms observed on *Cucumis sativus* and *Cucurbita pepo* were typical for *Cucumber mosaic* (CMV) and *Tomato aspermy viruses* (TAV). Besides necrotic symptoms on *nicotiana rustica* were common for TAV and *Tobacco rattle virus* (TRV).

Thus we conducted the infectious etiology of diseases on *Lilium*. Absence of reactions on some indicator plants post inoculation with sap from diseased plants, in our opinion, couldn't be explained with non-transmittance of

some viruses by mechanical inoculation or with insusceptibility of definite indicator plants to virus infection.

To determine virus nature of disease we conducted indirect and DAS-ELISA tests [4]. Same samples were analyzed in electron microscopy at 30,000 magnification.

Results of ELISA tests showed positive reactions of *Lilium* cultivar 'Royal gold', 'H-dawn' and 'Krema-2' with antisera to *Potato virus S* (PVS). We deem it could indicate contamination of these plants with *Lily symptomless virus* (LSV), which is serologically related to PVS [6].

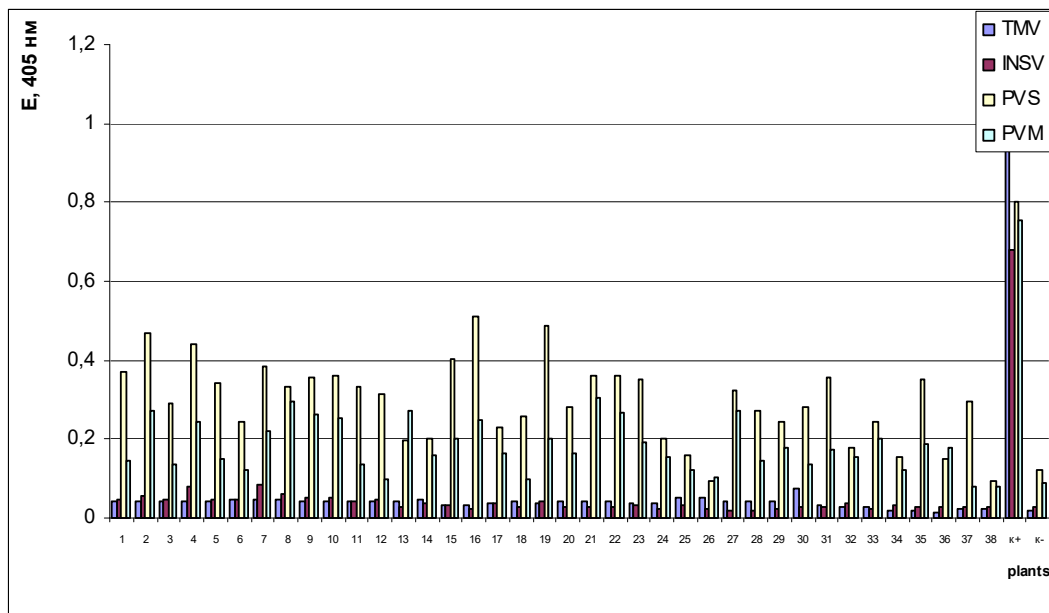


Fig.2. Results of ELISA testing of lily plants from the collection of M.M. Grichko' National Botanical Garden:

- 1 – Red Alert; 2 – Black Beauty; 3 – Elite (3n); 4 – Sunburst.; 5 – Heroes of Bres fortress; 6 – Magi; 7 – Krema-1; 8 – Kalinka; 9 – Black out; 10 – Conca D'or; 11 – Adelaide; 12 – Ce 6 Dazzle; 13 – Anastasia -2; 14 – Pink Perfection; 15 – Royal Gold; 16 – H-Dawn; 17 – Dream; 18 – Lilium henryi; 19 – Krema-2; 20 – Nymph; 21 – Rondo; 22 – Pagoda Bells; 23 – Touching; 24 – Conca D'or; 25 – Albung; 26 – H-9; 27 – Brigita; 28 – Anniversary; 29 – Anastasia; 30 – Criesdach Tetra Pink; 31 – Corona white; 32 – Yellow Planet; 33 – H-27; 34 – Saltarello; 35 – Mister Cas; 36 – hybrid Schenk; 37 – Kentucky; 38 – Original love; K+ – positive control; K- – negative control (normal plant)

Filamentous virus particles about 650 x 20 nm in size were observed in the sap of the plants. In addition, icosahedral particles were also observed, with a mean diameter of approximately 30 nm (Fig.3).

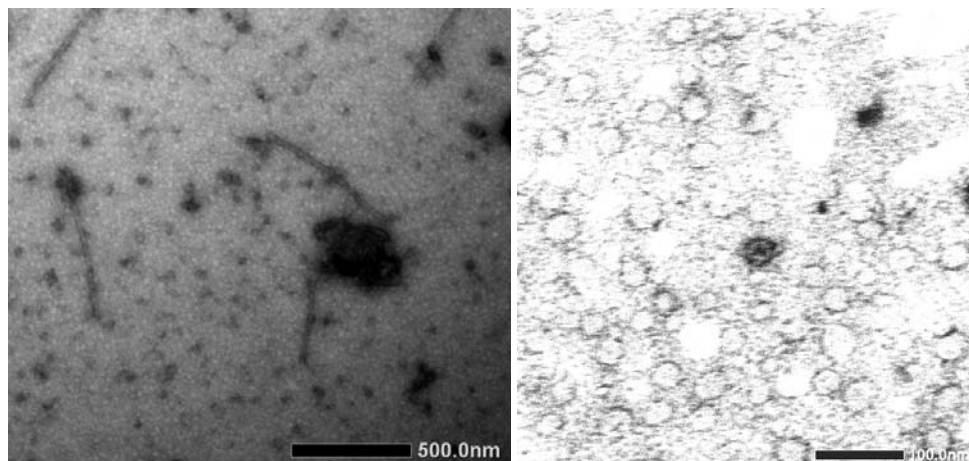


Fig. 3. Electron micrograph of viral particles in plant sap

Basing on serological, biological and morphological properties, we suggest that filamentous virus is related to *Lily symptomless virus*. Another virus is not completely identified, but symptoms induced on indicator plants suggested that it was *Tomato aspermy virus*.

Virus infections, especially latent diseases, are very dangerous because of the extensive exchange of untested plants among different botanical gardens and private collections. Additionally the incidence of such viruses as LSV which are generally symptomless in field-grown plants may cause problems while plants infected by other viruses. Besides, vegetative propagation of lilies without virus monitoring leads to uncontrolled distribution of viral infections within the collection.

#### References

1. Nesi B. Production of Lily symptomless virus-free plants by shoot meristem tip culture and in vitro thermotherapy/ Nesi B., Trinchello D., Lazzereschi S., Grassotti A., Ruffoni B. // Hortscience. – 2009. – 44(1). – P.217–219.
2. Farzadfar Sh. An investigation on characterization of cucumber mosaic virus isolated from lily green house in Damavand County, Iran/ Farzadfar Sh., Pourrahim R., Torkian M., Maleki M // Iranian Journal of Virology. – 2014. – 8(2,3). – P: 36-43.
3. Cees J.A. Control of aphid-borne Lily symptomless virus and Lily mottle virus in Lilium in the Netherlands/ Cees J.A., Pourrahim R., Torkian M., Maleki M // Virus Research. – 2000. – 71 (1,2). – P. 23–32.
4. Clark M.F., Adams A.N. Characteristics of the microplate method of the enzyme-linked immunosorbent assay for the detection of plant viruses/ Clark M.F., Adams A.N. // J Gen Virol. – 1977. – 34. – P.474-83.

5. Zheng HY, Chen J, Zhao MF, Lin L, Chen JP, Antoniw JF, Adams MJ. Occurrence and sequences of Lily mottle virus and Lily symptomless virus in plants grown from imported bulbs in Zhejiang province, China /Zheng HY, Chen J, Zhao MF, Lin L, Chen JP, Antoniw JF, Adams MJ. // Arch Virol. 2003 Dec;148(12):2419-28.
6. Genus Carlavirus. In: M.Q. King A., Lefkowitz E., Adams M. J., Carstens E. B. Virus Taxonomy. Ninth report of the International committee on taxonomy of viruses. Academic Press, San Diego, 924-927.

#### References (Scopus)

1. Nesi B., Trinchello D., Lazzereschi S., Grassotti A., Ruffoni B. Production of Lily symptomless virus-free plants by shoot meristem tip culture and in vitro thermotherapy // Hortscience. – 2009. – 44(1). – P.217–219.
2. Farzadfar Sh., Pourrahim R., Torkian M., Maleki M. An investigation on characterization of cucumber mosaic virus isolated from lily green house in Damavand County, Iran // Iranian Journal of Virology. – 2014. – 8(2,3). – P: 36-43.
3. Cees J.A. Control of aphid-borne Lily symptomless virus and Lily mottle virus in Lilium in the Netherlands // Virus Research. – 2000. – 71 (1,2). – P. 23–32.
4. Clark M.F., Adams A.N. Characteristics of the microplate method of the enzyme-linked immunosorbent assay for the detection of plant viruses // J Gen Virol. – 1977. – 34. – P.474-83.
5. Zheng HY, Chen J, Zhao MF, Lin L, Chen JP, Antoniw JF, Adams MJ. Occurrence and sequences of Lily mottle virus and Lily symptomless virus in plants grown from imported bulbs in Zhejiang province, China // Arch Virol. 2003 Dec;148(12):2419-28.
6. Genus Carlavirus. In: M.Q. King A., Lefkowitz E., Adams M. J., Carstens E. B. Virus Taxonomy. Ninth report of the International committee on taxonomy of viruses. Academic Press, San Diego, 924-927.

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### КАРЛАВИРУС ЛІЛІЇ В КОЛЕКЦІЇ НАЦІОНАЛЬНОГО БОТАНІЧНОГО САДУ ІМ. М.М. ГРИШКА НАН УКРАЇНИ

Проведено обстеження лілейних колекцій Національного ботанічного саду ім. М.М. Гришка на наявність вірусного ураження. За серологічними, біологічними та морфологічними властивостями виявлений вірус, подібний до безсимптомного вірусу лілій. Другий – остаточно не ідентифіковано, але за морфологічними характеристиками, реакцією рослин індикаторів можна припустити, що це вірус аспермії томатів.

Ключові слова: вірус лілій, вірус декоративних рослин.

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### КАРЛАВИРУС ЛИЛИИ В КОЛЛЕКЦИИ НАЦИОНАЛЬНОГО БОТАНИЧЕСКОГО САДА ИМ. Н.Н. ГРИШКО НАН УКРАИНЫ

Проведено обследование лилейных в коллекции Национального ботанического сада им. Н.Н. Гришко на наличие вирусного поражения. Опираясь на серологические, биологические и морфологические свойства изолированный вирус является есимптомным вирусом лилий. Второй вирус окончательно не идентифицирован, но по морфологическим характеристикам, реакцией растений индикаторов можно предположить, что это вирус аспермии томатов.

Ключевые слова: вирус лилии, вирус декоративных растений.