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ЗАСТОСУВАННЯ ГІС-ТЕХНОЛОГІЇ ДЛЯ МОНІТОРИНГУ ШАРКИ СЛИВИ НА ТЕРИТОРІЇ ОДЕСЬКОЇ ОБЛАСТІ

Віруси рослин викликають багато важливих хвороби рослин і несуть відповідальність за великі втрати і якість врожаю у всьому світі, і тому, агрономи і фітопатологи докладають значних зусилль для контролю за вірусними захворюваннями. Одиним з найбільш поширених вірусів, який викликає значні економічні втрати у роду Prunus це Plumpoxvirus (PPV), збудник шарки сливи. З моменту свого відкриття шарка є справжнім лихом для кісточкових садів Цей вірус присутній в кожній країні, в якій є промислове вирощування кісточкових дерев[1]. Вірусвідноситься до перелікурегульованихшкідливихорганізмівУкраїни. На територіїУкраїнизараженівірусом сади займаютьплощу в 4013,2764 га. В Одеськійобластіплощакарантиннихвогнищ становить 18,5 га. За останній час тут булознайдено 6 новихвогнищзагальноюплощею 28 га. Вперше в Одеськійобластівірус PPV був виявлений на деревах черешні. Персикові і сливові дерева уражаютьсяоднаковоюмірою. На скільки нам відомо, ми вперšевикористали ГІС-технологии для контролю за вірусними хворобамирослин в Україні. Правильневикористаннягеопросторовихданих є ключем до успіху контролю поширення PPV.

Ключові слова: Вірус віспи сливи, шарка сливи, фітосанітарний моніторинг, карантинне вогнище, ГІС технології.

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SPREAD OF *TURNIP MOSAIC VIRUS* IN SUSCEPTIBLE CROPS IS STRONGLY EFFECTED BY DIFFERENT CULTIVATION PRACTICES

Samples of plants showing symptoms of Turnip mosaic virus (TuMV) were collected from fields planted to Brassicaceae crops in Kyiv region and different locations in the city of Kyiv. TuMV was detected in the main brassica-crop fields, private gardens and urban locations of Ukraine, with a high overall incidence of 50%. This paper describes the effects of different cultivation approaches on the incidence rate of viral infection in susceptible crops and confirms the importance of preventive measures for disease control.

Key words: Turnip mosaic virus, cultivation practices.

Introduction. *Turnip mosaic virus* (TuMV) is a member of *Potyvirus* genus belonging to the largest *Potyviridae* family of plant viruses [1]. As many potyviruses, TuMV has an extremely wide host range but infects mostly plant species from the *Brassicaceae* family and induces persistent symptoms (mosaics, mottling, chlorotic lesions, etc.). For domesticated *Brassica* plants, TuMV is considered one of the most damaging and economically important viruses [2]. TuMV is mainly transmitted by many aphid species non-persistently as well as mechanically from plant to plant. TuMV probably occurs worldwide and has been found in both temperate and subtropical regions of Africa, Asia, Europe, Oceania and North and South America. In Europe, TuMV was reported from the UK, Spain, Italy, Greece, Germany, The Netherlands, Czech Republic, Hungary, Bulgaria, Poland, and Russia [3-9]. Despite Ukraine's geographical location and wide cultivation of different *Brassica* crops for centuries, it's only recently that the authors have registered TuMV in our country (unpublished data). In the study reported here, we describe the importance of preventive measures for the control of wide-spread and damaging pathogen of brassicas.

Materials and methods. Sampling was restricted to crop-producing areas in Kyiv region and different locations in the city of Kyiv where Brassicaceae plants were growing/cultivated. In Kyiv, sampling locations included two botanical gardens, the city center, Museum of Folk Architecture and Life of Ukraine (open-air location w/o agricultural activity), and private gardens where different brassica plants were regularly cultivated. Several large fields in Luka and Gorenychi villages used for commercial cabbage cultivation were chosen for sampling in Kyiv region. Brassica plants were visually examined, samples were collected from plants with TuMV-like symptoms typically including mosaics, mottling, vein banding and/or leaf deformation.

Collected samples were tested for TuMV by double antibody sandwich enzyme-linked immunosorbent assay (DAS-ELISA), as described previously by Clark and Adams (1977) [10], using specific polyclonal antibodies purchased from Loewe (Germany). Briefly, 0,5 g leaf tissue was ground to a powder with a mortar and pestle in 10 mL phosphate-buffered saline, pH 7,4, containing 0,05% Tween 20, 2,0% polyvinylpyrrolidone (MW 40 000) and 0,2% bovine serum albumin. In the meantime, microtitre plates (Maxisorb, NUNC, Denmark) were coated with TuMV-specific broad-spectrum polyclonal antibodies (1:200) in carbonate buffer according to the manufacturer's instructions. Leaf extracts were then added to the plates in duplicate wells and incubated overnight at 4°C. The presence of TuMV in the samples was detected in 200 µL homogenate by TuMV-specific antibodies conjugated to alkaline phosphatase using *p*-nitrophenyl phosphate substrate (Sigma, USA). Absorbance values at 405 nm were measured using a Multiscan-334 microtitre plate reader (Labsystem, Finland). Absorbance values, measured 60 min after adding the substrate, greater than three times those of the negative controls were considered positive.

Results and discussion. A total of 54 plant samples with TuMV-like mosaic and mottling symptoms were collected in different districts of the city of Kyiv and Kyiv region. Sampling areas included both agricultural sites (two cabbage producing fields and private gardens) and urban locations where no agricultural activity was carried out (different sites in the City of Kyiv, two botanical gardens and open-air Museum of Folk Architecture and Life of Ukraine).

Using ELISA, TuMV was detected in samples from cabbage, red radish, mustard, radish, white mustard, gold of pleasure, weed species (hill mustard), etc. (Table 1).

***Table* 1. Double-antibody enzyme-linked immunosorbent assay for the detection of *Turnip mosaic virus* by hosts**

Plant	No of samples	Positives	Incidence of TuMV infection (%)
Brassica oleracea (**cabbage**) *Brassica sp.*	23	8	35
Brassica juncea (**mustard**)	4	2	50
Sinapis alba (**white mustard**)	3	3	100
Raphanus sativus (**red radish**) *Raphanus sp.*	12	11	92
Other brassicas	5	3	60
Other non-brassicas (*Asteraceae*, *Primulaceae*, *Papaveraceae*, *Malvaceae*)	7	0	0
TOTAL	**54**	**27**	**50**

TuMV has been detected in 27 samples of plants (overall 50% incidence rate in symptomatic hosts) including *B. oleracea* var. capitata, *R. sativus*, *Raphanus* sp., *S. alba*, *B. juncea*, *C. sativa*, *Brassica* sp., and *Bunias orientalis*. On cabbage plants, TuMV typically induced systemic mosaics, vein banding and leaf deformation (Fig.1), whereas systemic mosaics and mottling were common for naturally infected radish and mustard plants.

Figure 1. TuMV-positive cabbage plant (*B. oleracea* var. capitata) showing virus-like symptoms of vein banding/clearing

TuMV was found in the main brassica-crop fields, private gardens and urban locations of Ukraine, with a high overall incidence of 50%. Importantly, the agricultural sites used for plant sampling were characterized with different level of incidence of TuMV infection varying from 17% and 42% for two crop fields, and to as much as 58% for private gardens (Table 2).

***Table* 2. DAS-ELISA detection of *Turnip mosaic virus* by sampling sites continuously used for crop cultivation**

Sampling site	No of samples	Positives	Incidence of TuMV infection (%)
Commercial cabbage producing field 1	6	1	17
Commercial cabbage producing field 2	12	5	42
Private gardens	12	7	58
Total for agricultural sites	**30**	**13**	**39**

Several sampling sites within the Kyiv city (i.e. where no agricultural activity was carried out) demonstrated even higher incidence rate of TuMV with the minimum value of 33% for symptomatic plants. These results suggest that TuMV is probably widespread in both agricultural and urban locations but remained undetected for a long time.

Expectedly, different locations demonstrated high but varying level of TuMV occurrence. However, several aspects were of special interest in this regard. For the two fields used for commercial cabbage production in Kyiv region and situated in neighboring villages just 5 km apart, the TuMV incidence rate varied from 17% to 42%. This probably reflects the efficiency of the confirmed regular eradication of diseased plants in the former case (field 1) and underpins the significance of long-known simple approach – elimination of virus inocula – for the disease control.

In turn, rather high rate of TuMV infection in private gardens (58%) may be explained by both growing of infected plants and repeated cultivation of susceptible crops, as reported by the landowners. Another approach allowing to limit virus spread – crop rotation – was also missing in this case.

Obtained results clearly demonstrate that trivial measures for crop cultivation (known for decades but often thoroughly disregarded) remain highly efficient in controlling the spread of the mechanically and aphid-transmitted virus and reducing consequential damages.

Conclusions. In summary, the survey indicated high occurrence of TuMV in urban and agricultural regions in Ukraine where average infection incidence rate reached 50%. Wide range of infected plant species and high incidence rate in surveyed areas obviously demonstrates both the lack of virus screening and important role of efficient cultivation approaches for disease control in Ukraine. Obtained data suggests a long-term coexistence of the virus and the hosts in Ukraine.

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ПОШИРЕННЯ ВІРУСУ МОЗАЇКИ ТУРНЕПСУ У СПРИЙНЯТЛИВИХ КУЛЬТУРНИХ РОСЛИНАХ СИЛЬНО ЗАЛЕЖИТЬ ВІД РІЗНИХ ПІДХОДІВ ДО ВИРОЩУВАННЯ

Зразки рослин с симптомами вірусу мозаїки турнепсу (TuMV) відбиралися с промислових полів вирощування хрестоцвітих культур у Київській обл. та на різних ділянках у місті Киев. TuMV був знайдений на всіх промислових полях, приватних присадибних ділянках та міських ділянках, а сумарний рівень інфекцій становив 50%. У даній роботі описуються наслідки застосування різних агроекологічних прийомів для поширення вірусу у сприйнятливих культурах та підтверджена важливість профілактичних заходів у боротьбі з вірусними хворобами.

Ключові слова: вірусу мозаїки турнепсу, вирощування хрестоцвітих культур.

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РАСПРОСТРАНЕНИЕ ВИРУСА МОЗАИКИ ТУРНЕПС У ВОСПРИИМЧИВЫХ КУЛЬТУРНЫХ РАСТЕНИЯХ СИЛЬНО ЗАВИСИТ ОТ РАЗНЫХ ПОДХОДОВ К ВЫРАЩИВАНИЮ

Образцы растений с симптомами вируса мозаики турнепса (TuMV) отбирались с промышленных полей выращивания крестоцветных культур в Киевской обл. и на различных участках в городе Киев. TuMV был найден на всех промышленных полях, частных приусадебных участках и городских участках, а суммарный уровень инфекций составил 50%. В данной работе описываются последствия применения различных агроэкологических приемов для распространения вируса в восприимчивых культурах и подтверждено важность профилактических мероприятий в борьбе с вирусными болезнями.

Ключевые слова: вируса мозаики турнепса, выращивание крестоцветных культур.

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FLORISTIC CLASSIFICATION OF THE FLOODPLAIN ALDER, WILLOW AND POPLAR FORESTS IN THE BASIN OF THE LOWER SULA (UKRAINE)

The floodplain alder (Alnus glutinosa), willow (Salix alba, rarely S. fragilis) and poplar (Populus nigra, P. alba, outliers of Populus x canescens) forests in the basin of the lower Sula were investigated. Mesohygrophilous forests of European black alder were referred to Alno-Ulmion alliance Querco-Fagetea class (com. Aegopodium podagraria-Alnus glutinosa, D. c. Acer negundo-Alnus glutinosa). Swamp forests of European black alder of Alnetea class are mostly common in the floodplains of small rivers and are represented by two associations (Carici ripariae-Alnetum glutinosae and Carici acutiformis-Alnetum glutinosae). The floodplain willow and poplar forests were referred to class Populetea albae (order Populetalia albae). Willow forests of floodplains of the river Sula and its tributaries and also waterlogged gully talwegs and rarely outliers belong to Salicion albae alliance and Salicetum albae association. Lower reach poplar forests of the river Sula floodplain belong to Calamagrostio epigei-Populion nigrae alliance and are divided into two associations that we propose to change in accordance with the requirements of the International Code of Phytosociological Nomenclature for Galio veri-Populetum nigrae and Strophiostomo sparsiflorae-Populetum albae. It is emphasized that the studied groups don't contain the species from the Red Data Book of Ukraine. The alder, willow and poplar forests of each association that are least transformed, largest in area and oldest require the nature reserve creation, that is proved by their significant water conservation role.

Key words: Querco-Fagetea (Alno-Ulmion), Alnetea, Populetea albae, Ukraine, Dnieper left-bank Forest-Steppe, basin of the lower Sula, syntaxonomy.

Introduction. The floodplain alder (*Alnus glutinosa* (L.) P. Gaertn.), willow (*Salix alba* L., rarely *S. fragilis* L.) and poplar (P*opulus nigra* L., *P. alba* L., *Populus* x *canescens* (Ait.) Smith. forests are located throughout the whole region of our research of the floodplain of Sula river and its brances, however on the left bench they are less numerous. Accumulation and generalization the data about its phytocoenotic diversity according to the methodology of