

UDC 576.858.8:582.572.225 = 20

Original scientific paper

## OBSERVATIONS ON INFECTION OF GARLIC (*ALLIUM SATIVUM* L.) WITH CUCUMBER MOSAIC VIRUS

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Received January 20, 1992

Cucumber mosaic virus (CMV), previously isolated from an unknown cultivar of autumn garlic (*Allium sativum* L. subsp. *sagittatum* Kuzn.), was transmitted to garlic cv. Mortvan already infected by latent filamentous viruses. Transmission of CMV was achieved by *Myzus persicae* and only from infected *Nicotiana megalosiphon*, *N. glutinosa* and *Chenopodium quinoa* but not from the garlic. The infected garlic plants growing in the open showed sporadic chlorotic streaks on leaves and flower stalk. The yield of cloves was markedly reduced, i.e. 54 and 35%, in comparison to the plants which held latent viruses only.

A rare presence of CMV in garlic and other cultivated *Allium* species is discussed.

### Introduction

Štefanac (1980) reported the isolation of cucumber mosaic virus (CMV) from an unknown cultivar of autumn garlic (*Allium sativum* L. subsp. *sagittatum* Kuzn.) including the symptoms it produced in this species in glasshouse conditions. The same garlic plants also contained filamentous latent viruses. This paper presents further data on the possibility of transmission and symptoms of CMV in garlic as well as on the influence of the virus on the yield of garlic. It also includes information which might explain a minor presence of CMV in this and other cultivated *Allium* species.

## Materials and Methods

The isolate CMV-G (in further text CMV) obtained previously (Štefanac 1980) was employed in this study. It was preserved in bulbils of the unknown garlic cultivar. For activation of CMV, the infected bulbils were set in steam sterilized soil and germinated plants used as a source of the virus for its mechanical transmission at first to certain ordinary test plants; from them (mostly the *Nicotiana* species) the virus was transferred by *Myzus persicae* to garlic cv. Moravan which was employed mostly in experiments of this study. The CMV infections of garlic plants were checked by back inoculation to *Chenopodium quinoa* or by double diffusion serological tests, or both.

The non-persistent aphid transmissions, if not stated otherwise, were performed as previously (Štefanac 1980).

Some young plantlets of cv. Moravan infected by CMV and those without CMV were planted in the open to obtain enough bulbils for experiments on the loss of yield provoked by CMV. All experimental plots were far away from any *Allium* cultivation.

The original seed (bulbils) of the garlic cv. Moravan was obtained from Mr. P. Havránek (Institute of Experimental Botany, Olomouc). The plants grown from this supply did not show any sign of virus infection; however, electron microscopy of leaf sap including its mechanical inoculation to *Chenopodium quinoa* (procedure used by Štefanac 1980) suggested the presence of filamentous latent viruses, probably of carla- and potyvirus groups, which were not identified precisely.

## Results

*Experiments on transmission of CMV to garlic*

Several times we succeeded in transmitting the CMV by *Myzus persicae* from infected plants of *Nicotiana megalosiphon*, *N. glutinosa* and *Chenopodium quinoa* to garlic cv. Moravan. The percentage of plants which became infected varied from 25—60%. On the other hand, attempts at mechanical transmission of the CMV to garlic cv. Moravan from the same sources were ineffective.

We also tried to transmit the CMV to garlic (of the unknown cultivar or cv. Moravan) from infected plants of garlic. The source of the virus was also the unknown cultivar employed earlier, or cv. Moravan. However, in these endeavours there was no success regardless of whether inoculations were performed by *M. persicae* (up to 35 infected aphids per a plant) or classic mechanical method.

*Symptomatology of CMV and its effect on the yield in cv. Moravan in mixed infections with latent viruses*

Two parallel experiments were set in the open at two different localities in Croatia which differed somewhat in climate conditions and type of the soil. One locality was in the area of Kordun and the other in Slavonia. At each locality 60 bulbils were planted which had been obtained from cv. Moravan plants infected with CMV and unidentified

latent viruses, and next to them approximately 50 control bulbils from plants which held the latent viruses only. All the bulbils were from the yield of the previous year. During the experiments the presence of CMV in each particular plant was tested (once when germinated plants reached a 20—30 cm height, and once a month before their maturation). CMV was demonstrated in approximately 80% garlics which germinated from bulbils of CMV infected samples, but in none of the control plants derived from samples infected only by latent viruses. The plants infected by the mixture of CMV and latent viruses occasionally manifested chlorotic or small white necrotic lines or streaks in some leaves; at the time of flowering the yellow stripes could also appear on inflorescence stalks. In no case was the symptom of split leaf noticed, earlier observed in the unknown garlic cultivar infected with CMV and latent viruses (Štefanac 1980). The control plants exhibited no sign of virus infection; at the time of maturation they retained green colour approximately two weeks longer than the plants which contained CMV in addition latent to viruses.

After maturation and collecting the yield, the total weight of cloves and separately of bulbils was determined for each group of plants from the two localities. Their mean weights per plant are presented in Table 1.

Table 1. The yield of garlic cv. Moravan infected by CMV and latent viruses, and by latent viruses only following cultivation in the open\*

Locality	Average yield of cloves (in gr)		Average yield of bulbils (in gr)	
	CMV + latent viruses	Latent viruses (control)	CMV + latent viruses	Latent viruses (control)
Slunj (Kordun)	2.77	4.25	0.96	0.99
V. Grđevac (Slavonija)	2.15	4.70	0.76	1.00

\*Numbers represent the average yield per plant from approximately 50 plants in each combination

As can be calculated from data in the Table, the average yield of cloves per plant infected with the mixture of CMV and latent viruses was approximately 54 i.e. 35% lower than that in the control plants. In the former, the yield of bulbils was also reduced particularly at the locality in Slavonia.

### Discussion

There are few data in the literature concerning infections with cucumber mosaic virus (CMV) of the cultivated herb and vegetable plants from the genus *Allium*. Thus, Smith (1972, p. 249) brings a small note on the chlorotic symptoms provoked by CMV in onion (*Allium cepa* L.).

This author also says that the virus appears not to be sap- but only aphid- transmissible to the same species. Štefanac (1980), however, transmitted her garlic (*A. sativum* L.) isolate of CMV to onion by infective sap of *Nicotiana megalosiphon*. She detected CMV in only one plant of garlic among several plants growing from bulbils collected in the University Botanic Garden (Zagreb).

This study was done primarily in order to investigate the effect of CMV on the yield of garlic in natural conditions. The experiments performed showed that the garlic cv. Moravan infected by CMV and flexuous latent viruses produced 54 i.e. 35% lower yield of cloves than that infected solely with latent viruses.

The experiment performed in this study and earlier (Štefanac 1980) further demonstrated that the aphid *Myzus persicae* could transmit CMV to garlic from some ordinary test-plants. The same aphid, however, in our experiments did not transmit the CMV from garlic to garlic. Aphid transmissions of CMV within garlic cultures in natural conditions could not be demonstrated either. These facts together with the specificity of aphids which occur on the members of the genus *Allium* could perhaps explain the rare detection (to the best of our knowledge on one occasion only) of CMV in garlic. The distinct species of aphids which reside on different *Allium*-s may be the main reason of the small probability of CMV transmissions from other plants to these species. Since garlic samples which contained CMV yielded distinctly smaller cloves it might be presumed that garlic plants infected by chance are eliminated from further cultivation when material for planting is selected.

In this study, the CMV could not be transmitted to garlic from garlic by mechanical inoculation of sap, either. This corresponds in a way with earlier data on the failure to transmit mechanically certain isolates of CMV to their original plants (Wolf 1968, Smith 1972, Horváth 1969, 1976).

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**Acknowledgement.** The authors thank Mr. P. Havránek, Institute of Experimental Botany, Olomouc, Czechoslovakia, for kindly providing the garlic bulbils.

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## SAŽETAK

ZAPAZANJA O INFEKCIJI ČEŠNJAKA (*ALLIUM SATIVUM* L.) VIRUSOM  
MOZAIKA KRSTAVCA

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Virus mozaika krstavca (CMV), već prije izdvojen iz nepoznatog kultivara jesenskog češnjaka (*Allium sativum* L. subsp. *sagittatum* Kuzn.), prenijeli smo na češnjak *cv.* Moravan koji je već bio zaražen latentnim nitastim virusima. Prenošnje virusa CMV postizali smo uz pomoć *Myzus persicae* no samo iz zaraženih primjeraka *Nicotiana megalosiphon*, *N. glutinosa* i *Chenopodium quinoa*, ali ne iz češnjaka. Zaražene biljke koje su rasle na otvorenom pokazivale su malobrojne klorotične pruge na listovima i cvjetnoj stapci. Njihov prinos bio je izrazito smanjen, tj. manji za 54 i 35% od prinosa biljaka koje su sadržavale samo latentne viruse.

Raspravljena je malena nazočnost virusa CMV u češnjaku i drugim kultiviranim vrstama roda *Allium*.

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