

## Biological decline in *Solanum nigrum* L. due to Tobacco Mosaic Tobamovirus (TMV) infection

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### Introduction

Weeds can influence the quality and quantity of crops by direct way (e.g., by competing for nutrient and water uptake), but they are also very important as alternative hosts of different pathogens. Weeds may be primary infection sources in the spread of plant diseases, while vegetative reproductive organs of perennials may be reservoirs of obligate parasites (e.g., viruses) (Kazinczi *et al.*, 1999, 2000). Biological decline of weeds due to virus infection has been recently studied. It has been stated earlier that virus infection influenced water relation (Kazinczi *et al.*, 1996, 1998a), nutrient uptake (Kazinczi *et al.*, 1998b), seed dormancy and seed viability (Kazinczi *et al.*, 2000), reduced growth and photosynthetic pigment content (Kazinczi *et al.*, 1996, 1998c).

The aim of our study was to examine the biological decline of a virophilous species (*Solanum nigrum*) due to Tobacco Mosaic Tobamovirus (TMV) infection.

### Material and methods

*S. nigrum* plants were mechanically inoculated at the 6 - 8 leaf stage with the U1 strain of TMV (TMV/U1) in our virological glasshouse. Leaf samples from the healthy and virus infected plants were collected at the flowering stage and nitrogen (N), phosphorus (P), potassium (K), sodium (Na), calcium (Ca), magnesium (Mg), zinc (Zn), copper (Cu), manganese (Mn) and iron (Fe) content was determined. Seventy days after planting and the fresh weight both of the shoots and roots were measured. Unripened (green) and ripened (blue-black) berries and seeds were counted on each plants, and seeds were collected from healthy and virus infected plants. Germination tests were carried out under laboratory conditions at 25 °C in Petri dishes. In order to determine viability of seeds the triphenyl tetrazolium chloride (TTC) test was carried out after the standard of the International Seed Testing Association (ISTA) (Moore, 1985).

### Results and discussion

There was no significant difference in the N, P and Ca content of the healthy and virus infected leaves of *S. nigrum*. The concentration of potassium (K) had risen twofold in the TMV infected leaves. The physiological and biochemical background of this unexpected observation is not yet clear. Na, Mg, Fe, Mn, Zn and Cu content of the leaves was significantly reduced due to virus infection (Table 1). In our previous experiments, we have stated that viruses influenced N, P, and K content of pepper leaves only before flowering and later (at the beginning of crop formation) no significant reduction was observed (Kazinczi *et al.*, 1998b).

TMV infection reduced the fresh weight of the shoots and roots by 78 and 82%, respectively. Average seed production of the virus infected plants was reduced by 52%, as compared to the healthy control ones, and TMV infection also delayed the generative development of *S. nigrum*, which was expressed in the higher proportion of the green berries (Table 1).

Higher germination percentages were obtained in light, than in dark conditions, and the germination of seeds derived from blue-black berries was also higher than the germination of

seeds derived from green berries. Virus infection did not influence the germination of *S. nigrum* seeds. The opposite effect was observed in the case of *Chenopodium album*, where *Sowbane Mosaic Sobemovirus* (SoMV) infection caused 15% reduction in germination (Kazinczi *et al.*, 2000). Seed viability was not influenced in the case of seeds derived from green berries, while viability of seeds derived from ripened (blue-black) berries was significantly reduced due to TMV infection (Table 1). SoMV infection also decreased seed viability of *Chenopodium* species by 1 - 23%, depending on species (Kazinczi *et al.*, 2000).

It is concluded that viruses unfavourably influence the physiological processes not only of the crops but also of the weeds. Therefore, in an indirect way, they can contribute to the reduction of weed populations.

Table 1. Biological decline in *Solanum nigrum* L. due to *Tobacco Mosaic Tobamovirus* (TMV) infection\*.

	Fresh weight (g plant <sup>-1</sup> )		Nutrient content							
	shoot	root	(%)						(mg kg <sup>-1</sup> )	
			N	P	K	Na	Ca	Mg	Fe	Mn
Control	88	43.2	5.78	0.33	2.05	0.16	2.05	1.02	92	28.7
	±4	±1.7	±0.83	±0.03	±0.18	±0.01	±0.06	±0.06	±1.9	±0.3
TMV- infected	41	9.5	5.29	0.37	3.90	0.1	1.96	0.73	38	15.8
	±7	±4.6	±0.23	±0.01	±0.17	±0.01	±0.05	±0.05	±6	±0.4
SD <sub>5%</sub>	3.3	3.6	0.57	0.06	0.24	0.02	0.11	0.02	5.95	0.47

  

	Nutrient content (mg kg <sup>-1</sup> )		Seed /plant	P	Seed viability		Germination %					
	Zn	Cu			U	R	U		R			
							L	D	L	D		
Control	42.3	5.5	3692	1:1.58	69	98	7.5	0	32.5	0.8		
	±1.6	±0.7	±760		±7	±1	±2.7	±0	±31	±0.9		
TMV- infected	39.2	2.3	1775	1.64:1	74	93	22.8	2	34	3		
	±0.5	±0.3	±431		±15	±4	±12.3	±0.8	±27	±2		
SD <sub>5%</sub>	1.24	0.58	734		6.56	3.49	19.9	19.9	19.9	19.9		

\* Abbreviations: D, dark; L, light; P, proportion of the green:blue-black berries in a plant; R, ripened (blue-black) berries; U, unripened (green) berries.

## References

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