

EFFECT OF ASPARAGUS VIRUS 2 ON YIELD OF ASPARAGUS (*ASPARAGUS OFFICINALIS* L.)

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Abstract. The quantity and quality of spears from asparagus plants infected with Asparagus virus 2 was lower in comparison to healthy plants. The total number of spears was decreased in 16% and mass of spears in 24.7%. Asparagus virus 2 reduced the number of marketable spears in 31.9%, and increased the number of unmarketable spears in 20.2%. The green mass of stem brushes of infected plants was reduced in 19.4% in field conditions and in 20% in seedlings growing in a greenhouse.

Key words: asparagus, Asparagus virus 2, yield decrease

I. INTRODUCTION

Virus diseases did not develop, in general, clear symptoms on asparagus plants, but accurate measurements pointed out that they had negative influence upon growth of plants, yield and overwintering ability. According to Jaspers (1996), AV2 caused in New Zealand about 18% reduction in asparagus yield in the first year of cultivation and 30% in the second year. Moreover, a decrease of marketable spear weight and an increase of unmarketable yield have occurred. Other asparagus viruses caused losses similar to those observed in the case of AV2.

The infection of plants with the mixture of two viruses is particularly damaging (Kegler et al. 1991; Weissenfels and Schmelzer 1976; 1976a; Yang 1979).

It was reported that Asparagus virus 2 infected asparagus plants in Poland commonly (Fiedorow 1996) but there was no information on its effect on plant yield and growth in our conditions. Regarding this, field and greenhouse experiments were carried out in the Department of Plant Pathology Agricultural University in Poznań to find long-term effects of Asparagus virus 2 on asparagus plants.

II. MATERIAL AND METHODS

The effect of AV2 on spear yield of asparagus cv Mary Washington was evaluated in a field experiment and plant growth was evaluated in the field and in greenhouse experiments. In all experiments plants infected with AV2 were obtained from infected seeds. Seeds were collected from AV2 infected mother plants, and seedlings were tested biologically on *Chenopodium murale*.

In the field experiment, 58 asparagus plants were tested. In the first year of trial 31 plants were infected with AV2 and 27 remained healthy, in the second year 38 were infected and only 20 appeared to be healthy. One-year old seedlings, both infected and healthy ones,

were planted in 1994, randomly in one plot, with spacing 1.3 x 0.45 m, in six rows, ten plants in one row. The increase in number of infected plants in the second year resulted from natural spreading of virus.

The yield of spears was evaluated in 1996 and 1997. Spears were collected every two days, separately from each plant. Mass, length and diameter of spears were measured. Spears were divided into sorts (Extra, I, II and out of sort) on the basis of their dimensions, according to EU standard (Knaflowski 1995). The total number and mass of spears from each healthy and infected asparagus plant was summarized every year, when spears yielding came to the end.

Number, mass and length of stem brushes were measured in September of 1996 and 1997. Stems were cut off at the base, separately from each plant. The spear yield and green mass of healthy and infected plants were compared statistically with Student t-test.

The AV2 effect on the growth of asparagus seedlings was examined in the greenhouse experiment. Asparagus seedlings, 30 infected and 30 healthy, were planted in 10 cm pots, in April. Young stem brushes were cut off and measured (number, mass and length) three times: after 6, 12 and 16 months from the time of planting. Asparagus plants were replanted into pots of larger size after each cutting.

III. RESULTS

The yield of spears from AV2 infected plants was lower and of poorer quality than the yield of healthy plants. Number of spears was reduced by 13.2% in the first year and by 18.7% in the second year of yielding and their mass by 18.6% and 30.8%, respectively. The number of spears was reduced in good quality sorts but it was increased in out of sort group. The yield reduction and the quality deterioration became more intensive in successive years of disease continuance (Tab. 1).

The green mass, number and length of stem brushes of AV2 infected asparagus plants were lower in comparison with healthy ones, both in field and greenhouse experiments (Tabs. 2, 3).

Table 1

Effect of Asparagus virus 2 on spear yield of asparagus cv Mary Washington

Year of yielding	Treatment	Mean value for one plant						Mean mass of one spear (g)
		number of spears						
		in sorts					total	
		extra	I	II	out of sort			
First	Healthy plants	1.3	2.5	2.1	3.2	9.1	178.8	19.4
	Infected plants	1.0	2.0	1.3	3.6	7.9	145.5	17.0
	Difference %	23.1	20.0	38.1	11.2	13.2	18.6	12.4
Second	Healthy plants	3.6	5.3	4.6	4.1	17.6*	443.3	25.2
	Infected plants	2.4	3.4	2.7	5.8	14.3*	306.6	21.4
	Difference %	33.3	35.8	41.3	29.3	18.7	30.8	15.1
Mean value for two years		28.2	27.9	39.7	20.2	16.0	24.7	13.7

* Values significantly different at level 0.05

Table 2

Effect of Asparagus virus 2 on stem brushes growth of asparagus plants in field conditions

Year of yielding	Treatment	Mean value for one plant		
		number of stems	mass of stems (g)	length of stems (cm)
First	Healthy plants	8.2	316.5	121.3
	Infected plants	7.0	242.9	117.0
	Difference %	14.6	23.3	3.5
Second	Healthy plants	9.2	662.0	120.2
	Infected plants	7.1	546.0	105.7
	Difference %	22.8	15.5	12.1
Mean value for two years		18.7	19.4	7.8

Table 3

Effect of Asparagus virus 2 on the growth of asparagus seedlings

Treatment	Age of seedlings (months)	Mean value for one plant		
		number of stems	mass of stems (g)	length of stems (cm)
Healthy plants	6	7.1	7.1	39.6
	12	1.4	13.2	91.8
	18	1.6	10.9	111.7
	total	10.1	31.2	243.1
Infected plants	6	6.8	6.6	38.1
	12	1.3	10.5	90.8
	18	1.2	7.9	108.5
	total	9.3	25.0	237.4
Difference %		7.9	20.0	2.4

IV. DISCUSSION

Results of the experiments point out the disadvantageous effect of Asparagus virus 2 infection on growth and yield of asparagus. Mean reduction in number of spears was about 16% and in spear mass 24.7%. These values were similar to those reported by other authors (Weissenfels and Schmelzer 1976; Weissenfels and Schmelzer 1976a; Yang 1979; Jaspers 1996), who estimated the virus caused decrease of the whole yield at 20% and that of good quality yield at 10 - 30%. Loss of asparagus yield caused by viruses was mainly in connection with poorer quality of spears resulting from the reduction of their size and mass. According to our results, mass of virus-infected spear was reduced meanly by 13.7% in comparison with healthy one. Keggler et al. (1991) published similar results.

Number of stem brushes produced with AV2-infected plants as well as their mass and height were also reduced. Difference between healthy and infected plants was not higher

than 25%, sometimes only a few percent. These results are similar to those obtained from field experiments performed in Germany (Weissenfels and Schmelzer 1976; 1976a) and the USA (Elmer et al. 1996).

Longer time of infection of asparagus plants caused damages to larger extent than injuries induced by the short time of infection. Jaspers (1996) also obtained experimental data pointing to a correlation between duration of the disease and reduction in spear mass.

Results presented in the paper bring us into the conclusion that virus diseases diminish profitability of asparagus plantations because of decrease of spear yield, its lower value and reduction in the growth of stem brushes. The extent of virus-caused damage observed in asparagus plants in Poland was similar to that reported in the field experiments carried out in other countries.

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WPLYW ASPARAGUS VIRUS 2 NA PLON SZPARAGA (*ASPARAGUS OFFICINALIS* L.)

STRESZCZENIE

W latach 1996 i 1997 przeprowadzono doświadczenia dotyczące wpływu Asparagus virus 2 na plon wypustek bielonych i wytwarzanie świeżej masy przez rośliny szparaga (*Asparagus officinalis* L.) odmiany Mary Washington. Doświadczenia prowadzono w warunkach polowych oraz w szklarni.

Stwierdzono, że rośliny zakażone przez wirus wytworzyły mniej wypustek niż zdrowe, średnio o 16%, a masa wytworzonych wypustek była mniejsza średnio o 24,7%. Liczba wypustek w wyborach handlowych spadła o 31,9%, natomiast poza wyborem wzrosła o 20,2%. Obniżenie plonu i pogorszenie jakości wypustek nasilało się w miarę wydłużania czasu trwania choroby. W doświadczeniu polowym świeża masa pędów zakażonych przez wirus była mniejsza o 19,4% w porównaniu do pędów zdrowych. Świeża masa siewek szparaga, uprawianych w doświadczeniu szklarniowym, była o 20% mniejsza u roślin zakażonych przez wirus niż u roślin zdrowych.