From Researches on the Healthiness of Gladiolus (*Gladiolus* sp. L.) Corms in Reproduction Crops

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Abstract

The results of laboratory and field tests are presented. An effect of the quality of vegetative reproduction material of gladiolus cultivar's Wars on spouting and growing of young plants as well as on the healthiness and quality of progeny corms are analysed. In addition, corm diseases are diagnosed and corresponding pathogens are identified.

Keywords: gladiolus (sword lily); fungi; quality and healthiness

INTRODUCTION

The health state of vegetative material used in plant propagation is one of the basic conditions of its success. Gladiolus plants require a light soil that gives the best growth, while waterlogged soils occurred the corm putrefaction (PINDEL 1996). It is recommended to sow gladiolus in the next year after manure adding bark composts from deciduous trees enhances the gladiolus growth and healthiness (WIŚNIEWSKA-GRZESZKIEWICZ 1982). The corms purchased by the market and amateur flower-growers are often deteriorated with signs of disease. The aim of this paper was to determine an effect of the quality and healthiness of vegetative reproduction material on the dynamics of sprouting and growth of corms.

MATERIAL AND METHODS

The researches were carried out in the field in Dębica and laboratory of the Department of Plant Protection at the Cracow Agricultural University during periods 1995/96–1997/98. The plant material, i.e. 800 corms of gladiolus cultivar's Wars was purchased at SHRO POLAN.

Field experiments: such experiments were carried out three times during sprouting plants in four combinations: specially damaged diseased corms, specially damaged healthy corms, diseased corms no damaged, healthy corms no damaged to determine the dynamics of plant sprouting, percentage of non-sprouting corms and of dying plants during the vegetation period, percentage of corms of accordance circumferences.

Laboratory tests: every year the corms were analysed to investigate the mycoflora and the percentage of infested corms twice: after digging up – before storage, after storage – before sowing. The degree of corm infestation was expressed by the degree of general infestation in % described by the Townsende-Heuberger formula according to ZAMORSKI (1984). To identify the pathogens responsible for observed lesions microorganisms were isolated from diseased tissues and placed on the PDA medium and then based on the monospore fungi cultures the isolated fungi species were identified according to the methodological keys (PIDOPLICZKO 1977; DOMSCH & GAMS 1980; ELLIS & ELLIS 1985).

RESULTS

The plants growing from the test corms were of similar dynamics of growth and development (Table 1). Every year and at each analysis the percentage of sprouting plants was similar for each combination, while it reached the highest value for specially damaged healthy corms. The highest percentage of non-sprouting corms was found for specially damaged diseased corms. All specially damaged healthy corms sprouted in the first year. The percentage of dying plants during vegetation was similar in all combinations, in particular for diseased corms. No dying plants were found for healthy corms.

Table 1. Quality of gladiolus corms

Tested features	Combinations of experiments		Healthy corms no damaged	Specially damaged healthy corms	Diseased corms no damaged	Specially damaged diseased corms
Dynamics of plant sprouting (%)	I	a	88.85	93.30	93.25	90.00
		b	95.25	99.25	97.75	96.50
		c	96.75	100.00	98.00	96.50
	II	a	90.00	93.00	92.50	87.50
		b	96.00	95.50	94.00	90.00
		c	99.00	97.00	96.00	94.00
Amount of corms (%)	Not-sprouting	I	3.00	0.00	2.00	4.00
		II	1.00	3.00	4.00	6.00
	Dying during vegetation	I	0.00	8.00	8.12	8.33
		II	0.00	3.50	6.70	7.50
Amount of corms of accordance circumference (%) 1 year/2 year	>14 cm		30.44/32.00	39.96/42.20	32.21/36.50	37.77/41.00
	14–12 cm		27.54/30.50	27.93/31.00	18.50/20.30	15.20/17.30
	12–10 cm		31.05/33.50	22.55/25.00	27.69/30.00	28.97/32.50
	10–8 cm		8.34/10.00	6.16/8.50	19.08/23.00	12.69/14.00
	8–6 cm		2.00/3.50	4.13/5.50	2.50/3.70	4.00/5.60

I, II = first and second year of crop; a, b, c = three deadlines of analyses

The healthiness of new corms considerably decreased after storage (Table 2). Both progeny corms produced from healthy and diseased corms have demonstrated a large percentage of highly infected corms. It should be noted that the healthiness of parent corms was very low, regardless of combination. Every year above 50% of corms under examination have shown symptoms on its surface. They were located mainly on the heel in groups or individually. The phytopathological diagnostics of tested corms led to identification of the following symptoms of disease: A – husk spot, sunken lesions with black rough margins. Parenchyma is visible through infected tissues. The greatest number of such lesions was found on diseased damaged or no damaged corms; B – pale brown-to-brown spot with brighter borders located on husks. The very high percentage of such lesions was found; C – yellow-brown aqueous streaks visible on corms section spreading through the flesh from the corm core to the surface. The roots of such

Table 2. The healthiness of progeny corms

	Percentage of diseased (%)				General index of infestation (%)			
	I		II		I		II	
	a	b	a	b	a	b	a	b
Healthy corms no damaged	70.00	75.00	65.00	72.00	56.60	61.00	51.30	57.00
Specially damaged healthy corms	91.02	95.00	85.00	93.00	59.97	65.30	54.80	59.80
Diseased corms no damaged	95.16	99.00	90.00	95.50	69.30	75.90	63.20	71.25
Specially damaged diseased corms	100.00	100.00	97.00	100.00	75.46	81.50	71.00	79.00

I, II = first and second year of test; analyses: a = after digging up and before storage, b = after storage and before sowing

Table 3. Fungi isolated from parts of corms and types of symptoms of diseases

Fungus species	Number of colonies		Parts of corm								Symptoms		
			external surfaces		internal surfaces		heel		root		A	B	C
	I	II	I	II	I	II	I	II	I	II			
Alternaria alternata (Fr. Keissler; Ellis)	2	4	+	+	+	+							
Botrytis convoluta (Whetzel el Dryt. Menz.)	3	5	+	+			+	+					
Curvularia lunata (Wakker Boed. Spraque)	12	10	+	+	+	+							
Fusarium oxysporum (Schlecht. Snyd. et Hans. f.sp. *gladioli* Mass.)	6	9					+	+	+	+			+
Penicillium sp. Link	18	15	+	+	+	+		+	+	+		+	
Peziza L. Ex. St.-Am.	3	5					+	+					
Phialophora cyclaminis v. Beyma. Schol-Schwarz	4	7					+	+	+	+			
Rhizoctonia solani Kuhn.	5	9	+	+	+	+					+		
Stromatinia gladioli (Drayton) Whetzel.	3	5					+	+					
Talaromyces flavus (Klocker) Stolk Samson var. *flavus*	4	6	+	+			+	+					
Trichothecium roseum Link.	2	7			+	+							
Total	62	82											

+ = fungus occurrence; I, II = first, second year's analyses; symptoms: A = sunken black spot, B = pale brown or brown spots with bright border, C = yellow-brown aqueous spot on corm section

infected corms were covered with dark red spots and its bark is loosened.

The microbiological analysis led to extraction of 144 fungus colonies among which 11 species were identified (Table 3). *Penicillium* and *Curvularia* predominated among isolated fungi. *Penicillium* spp. was the only species that was present on each part of tested corms. *Curvularia lunata* colonised the external and internal husk layers. *Fusarium oxysporum* f.sp. *gladioli* were found on the heel and roots only, while *Rhizoctonia solani* – on the external and internal husk layers. The remaining isolated and identified fungi were occurred as complex on tissues of diseased corms. Strictly specified fungi species were identified on diagnosed symptoms as follows: type A – *Rhizoctonia solani*; type B – *Penicillium* spp. and type C – *Fusarium oxysporum* f.sp. *gladioli*.

DISCUSSION

It is commonly believed that the fungus *Fusarium oxysporum* f.sp. *gladioli* is most harmful to gladiolus (Remotti & Loffler 1996), especially latent forms of fungi (Henis & Zilberstein 1973; Bartyńska 1995). It leads to corm mummification during storage. The presence of fungi *Penicillium* in tissues of diseased corms is consistent with information published by Skrzypczak (1995), they concluded that corm diseases are caused mainly by the fungus *Penicillium corymbiferum*. The fungi *Rhizoctonia solani* becomes more and more dangerous to gladiolus crops and spreads easily from the soil as well with containers. The fragments of its mycelium can spread with air borne dust (Skrzypczak 1996). The fungi isolated and identified above are fully responsible for corm disease symptoms diagnosed, thus supporting the mentioned facts.

Another fungi that infect gladiolus leaves, flowers, roots and corms, too are *Botrytis gladiolorum* (Westcott 1971). This fungus has not been found in the tests described above, although the species *Botrytis convoluta* – believed to be pathogen to bulbous plants (Pidopliczko 1977) was identified.

Alternaria, *Fusarium, Botrytis, Rhizoctonia*, *Phialophora* identified in diseased corms spreads easily in the soil (Skrzypczak 1992). The occurrence of soil-borne fungi in gladiolus corms widens the source of infection in the environment. The quality and healthiness of parent plat material is a most important and may spread of these pathogens on other plants and sites

of plant growing. A negative effect of mechanical damage has been proven in many papers (GORLENKO & PAŃKO 1977). It is necessary to study the effect of agrotechnical and atmospheric factors of the health state of gladiolus corms during vegetation and storage and to determine the method of protecting them against soil fungi.

In conclusion, the quality of vegetative gladiolus material decides on the healthiness of progeny corms and mechanical injuries enhance infection. *Penicillium* spp., *Fusarium oxysporum* f.sp. *gladioli*, *Rhizoctonia solani* can predominate on progeny corms and cause the specific disease symptoms. Other fungi isolated from corms can colonise the corms occasionally.

References

BARTYŃSKA M. (1995): Soil-borne pathogens in crocus (*Crocus* L.) corms during the storage periods. The Polish Phytopathological Society, Section For Biological Control of Plant Diseases, Research Institute of Pomology and Floriculture. Biological control of soil-borne and post-harvest pathogens. Skierniewice 1995: 113–119.

DOMSCH K.H., GAMS W. (1980): Compendium of Soil Fungi. Academic Press, London, New York, Toronto, Sydney, San Francisco.

ELLIS M.B., ELLIS J.P. (1985): Microfungi on Land Plants an Identification Handbook. New York.

GORLENKO S.W., PAŃKO N.A. (1977): Zaszczita łukowicznych i kłubniełukowicznych kultur ot bolezniej i wreditieliej. Nauka i Tiechnika, Minsk.

HENIS Y., ZILBERSTEIN I. (1973): Detection of latent *Fusarium* in gladiolus corms. J. Hortic. Sci,, **48**: 189–194.

PIDOPLICZKO H.M. (1977): Griby parazity kulturnych rastienij, Opriedielitiel: 1–2, Naukowa Dumka, Kijew.

PINDEL Z. (1996): Czas na dalie i mieczyki. Działkowiec, **1**: 6.

REMOTTI P.C., LOFFLER H.J.M. (1996): The involvement of fusaric acid in the buls-rot *Gladiolus*. J. Phytopathol., **144**: 405–411.

SKRZYPCZAK CZ. (1992): Choroby cebulowych roślin ozdobnych w Polsce. In: Materialy Konf. Nowe tendencje w ochronie cebulowych roślin ozdobnych. Skierniewice 1992: 3.

SKRZYPCZAK CZ. (1995): Ochrona ozdobnych roślin cebulowych. Wyd. Plantpress, Kraków.

SKRZYPCZAK CZ. (1996): Ryzoktonioza mieczyka i jej zwalczanie. Warzywa, Owoce, Kwiaty, **10**: 16.

WESTCOTT C. (1971): Plant Diseases Handbook. Van Norshard Reihold Company, New York, Cincinati, Toronto, London, Melbourne.

WIŚNIEWSKA-GRZESZKIEWICZ H. (1982): Zastosowanie kory sosnowej jako nawozu ogrodniczego w uprawie mieczyków. Rośliny ozdobne, ISiK-Skierniewice.

ZAMORSKI CZ. (1984): Zasady identyfikacji grzybów patogenicznych dla roślin. In: Materiały do zajęć specjalistycznych z fitopatologii, cz. III, skrypt SGGW, Warszawa.