Contribuţii Botanice, *XXXIX*, **2004**
Grădina Botanică "Alexandru Borza"
Cluj-Napoca

PARASITE FUNGI ON SOME ORNAMENTAL IRIDACEAE (I)

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Abstract: There was done an inventory of the most common fungi on ornamental Iridaceae from Romania, according to literature.

Fusarium oxysporum f. sp. *gladioli, Penicillium gladioli, Botrytis gladiolorum, B. cinerea, Septoria gladioli, Puccinia iridis*, and *Septoria iridis* are frequently encountered on these plants.

Some fungi (*Fusarium oxysporum* f. sp. *gladioli, Penicillium gladioli, Botrytis cinerea*) were frequently identified on some ornamental Iridaceae from "Al. Borza" Botanical Garden from Cluj-Napoca. In order to identify these fungi, it was necessary to isolate them, to cultivate on nutritive medium and to examine them by means of the light microscope.

Introduction

Gladiolus hybridus, Freesia hybrida, Iris florentina, I. germanica, Crocus sativus are some of the most cultivated Iridaceae [8].

Ornamental value of these plants is affected by different pathogens, and we mention parasite fungi. They are different with regard to their level of parasitism [9].

Fusarium oxysporum f. sp. *gladioli, Botrytis gladiolorum, B. cinerea, Penicillium gladioli, Puccinia iridis, Uromyces croci, Alternaria tenuis, Urocystis gladioli* are the main parasite fungi on ornamental Iridaceae [1, 12].

These fungi cause characteristic mycoses on host plant, such as plant wilt, gray mold, blue mold, rust, blight, smut, etc.

Mycoses' symptoms are the result of the interactions between host plant, pathogen and environmental conditions [6].

In our research, some common mycoses were identified on ornamental Iridaceae in "Al. Borza" Botanical Garden from Cluj-Napoca.

Material and Method

Between 2003-2004, the common mycoses caused by *Fusarium, Penicillium*, and *Botrytis* species were observed on ornamental Iridaceae from "Al. Borza" Botanical Garden from Cluj-Napoca.

Pathogenic fungi were isolated from host plant, were "in vitro" cultivated on nutritive mediums (Czapek-agar, malt-agar), and were examined by means of a light microscope, in order to identify them.

Fusarium oxysporum f. sp. *gladioli* and *Penicillium gladioli* fungi were isolated from *Gladiolus hybridus* and *Freesia hybrida*. Bulbs (corms) were cut in small fragments and were disinfected according to literature [4]. The fragments were put in wet chambers and after 4 days, the characteristic mycelium and sporulation appeared. They were isolated and "in vitro" cultivated on nutritive medium.

The nutritive medium (Czapek-agar, malt-agar) was prepared according to literature [4, 11].

Fungic colonies were observed at equal periods of time (3, 6, 9 and 12 days) and data regarding colony's growth, sporulation and sclerotia were wrote down, according to species.

Results and Discussion

A common disease on ornamental Iridaceae from "Al. Borza" Botanical Garden from Cluj-Napoca is plant wilt caused by *Fusarium oxysporum* f. sp. *gladioli*. This fungus causes plant wilt and dry rot of bulbs (corms) in *Gladiolus* spp., *Freesia* spp., etc.

Fusarium oxysporum f. sp. g*ladioli* forms fluffy, white mycelium and sporulation made up of conidiophores and conidia, when cultivated on nutritive medium.

There are two types of conidia: macroconidia (13-46 × 3.2-4.8 µm) and microconidia (5-12 × 2.2-3.5 µm). Macroconidia are 1, 3, 5, 7 – septate. Beside these, the fungus also forms resting spores, called chlamydospores (7-17 × 7-10 µm) [11].

On Czapek-agar nutritive medium, *Fusarium oxysporum* f. sp. *gladioli* fungus forms a less developed mycelium with weak sporulation. Speed rate of colony's growth is also reduced, compared to malt-agar nutritive medium.

Three days after cultivation on Czapek-agar nutritive medium, *Fusarium oxysporum* f. sp. *gladioli* fungus has a fluffy, white, slightly raised up mycelium of 20 mm in diameter (Fig. 1).

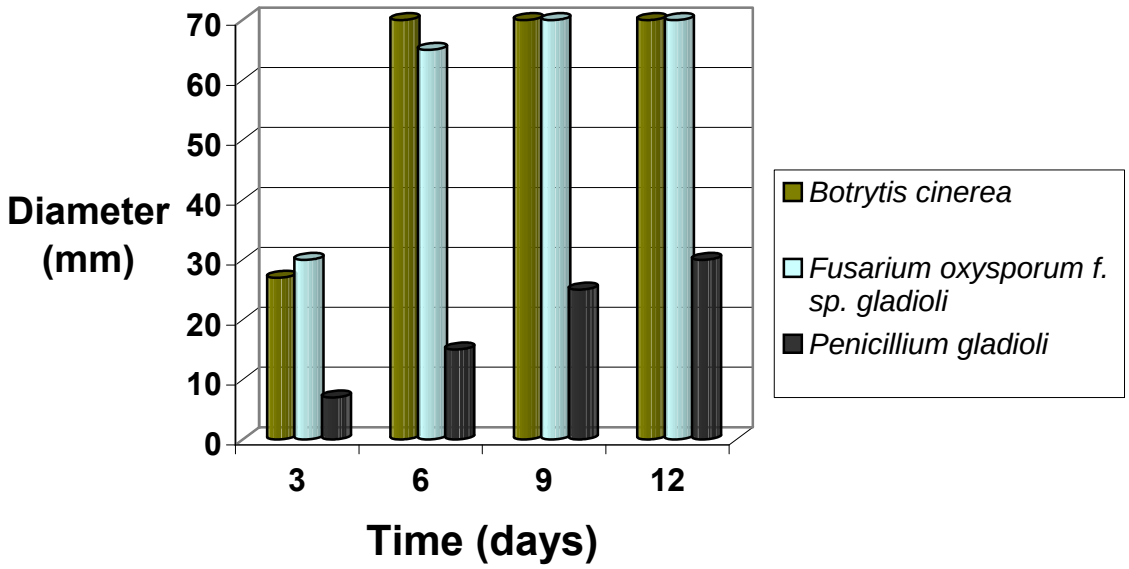

Fig. 1: The effect of Czapek-agar nutritive medium on "in vitro" growth of some parasite fungi isolated from ornamental iridacee

After 6 days, the hypothallus becomes pinkish. After 9 days from cultivation, the mycelium gets slightly yellow and occupys almost all the surface of Petri plate (70 mm in diameter). The sporulation is abundant after 12 days from cultivation on Czapek-agar nutritive medium.

In case of cultivation on malt-agar nutritive medium, *Fusarium oxysporum* f. sp. *gladioli* fungus grows faster. After 6 days from cultivation, colony's diameter is almost 65 mm and the mycelium is fluffy, white and has a radial growth (Fig. 2).

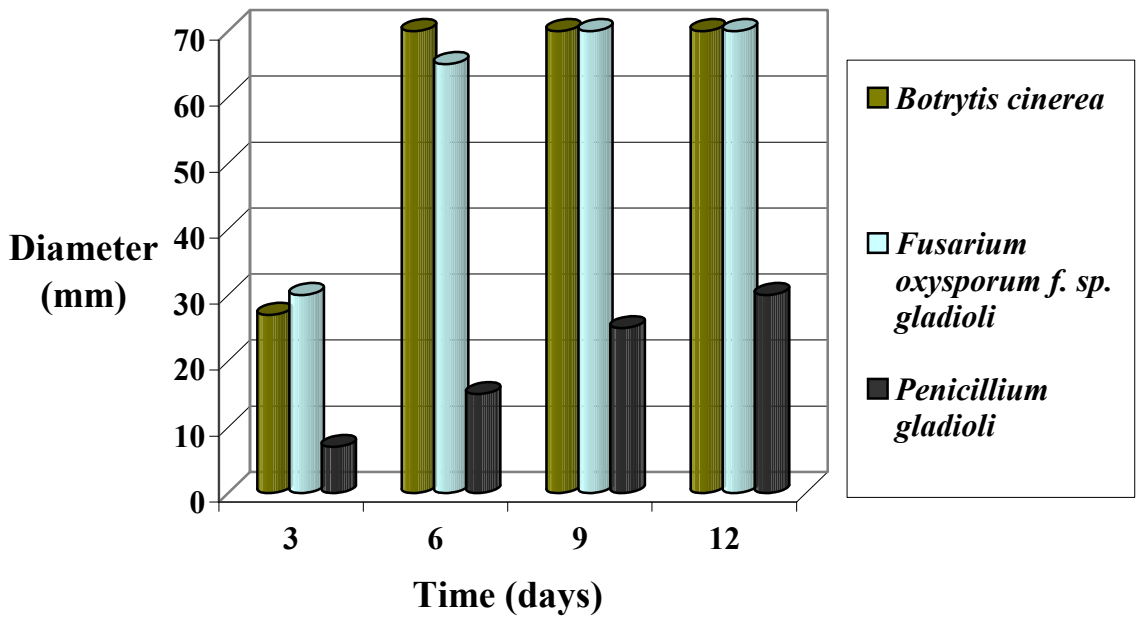

Fig. 2: The effect of malt-agar nutritive medium on "in vitro" growth of some parasite fungi isolated from ornamental iridacee

Penicillium gladioli fungus causes blue mold of *Gladiolus hybridus, Freesia hybrida*. *Penicillium gladioli* forms blue-green sporulation made up of conidiophores and conidia, when cultivated on nutritive medium.

Conidiophores are branched and grouped together. Two to four metulae are formed on each branch. Phialides are formed on metulae and are verticillated.

Conidial chains are formed on phialides. Conidia are ovoid and have 3-4 × 2-3.4 μm [12].

When cultivated on Czapek-agar nutritive medium, *Penicillium gladioli* grows very slow. At 6 days from cultivation, the mycelium is raised up in the central part and has approximately 10 mm in diameter (Fig. 1). After 9 days, fungus' mycelium becomes gray-greenish.

Growth rate is very reduced and consequently, after 12 days from cultivation, colony's diameter is about 25 mm, but the sporulation has its characteristic blue-green color.

On malt-agar nutritive medium, *Penicillium gladioli* fungus forms more abundant sporulation. Growth rate is higher. Colony's diameter is 7 mm at 3 days from cultivation and almost 30 mm after 12 days (Fig. 2).

Generally, *Penicillium* species grow very slow on nutritive medium.

Botrytis cinerea fungus causes gray mold of plants. This species was isolated from *Freesia hybrida*. On nutritive medium, the fungus forms mycelium, sporulation and sclerotia. The mature sporulation is brown and made up of conidiophores and conidia (9-12 × 6.5-10 μm) [10].

Colony's growth, sporulation and sclerotia are influenced by the nutritive medium's composition.

On Czapek-agar nutritive medium, *Botrytis cinerea* fungus forms, firstly, a fluffy, white and raised up mycelium. After 6 days from cultivation, the mycelium becomes gray and the sclerotia are not formed yet. At 9 days, fungus'sporulation becomes more abundant and has a characteristic gray color; the mycelium occupys the entire surface of Petri plate (70 mm in diameter). The sclerotia are formed, but they are small and just a few. After 12 days from inoculation, the number of sclerotia is greater and their size is also bigger (Fig. 1).

On malt-agar nutritive medium, *Botrytis cinerea* grows faster. After 6 days from cultivation, the sporulation is gray, abundant and occupys the entire surface of Petri plate. Sclerotia appear only after 9 days from cultivation, but they are very small and less numerous than in case of Czapek-agar nutritive medium.

Malt-agar nutritive medium induces the formation of a more abundant sporulation, while Czapek-agar nutritive medium determines the formation of many sclerotia, for *Botrytis cinerea* fungus.

There were mention many parasite fungi on ornamental Iridaceae from Romania (Table 1).

Table 1: Parasite fungi identified on ornamental Iridaceae from Romania (after Bontea, 1986; Săvulescu et al., 1969)

No. crt.	Host plant	Parasite fungus	Disease
1.	*Crocus sativus*	*Puccinia croci* *Uromyces croci*	Rust
		Penicillium gladioli	blue-mold
2.	*Freesia hybrida*	*Fusarium oxysporum* f. sp. *gladioli*	plant wilt, dry rot
		Septoria gladioli	leaf spotting
		Botrytis cinerea	gray mold
3.	*Gladiolus hybridus*	*Penicillium gladioli*	blue mold
		Fusarium oxysporum f. sp. *gladioli*	plant wilt, dry rot
		Botrytis gladiolorum	gray mold
		Septoria gladioli	leaf spotting
		Urocystis gladioli	Smut
		Alternaria tenuis	Blight
4.	*Iris germanica*	*Puccinia iridis*	Rust
		Botrytis cinerea	gray mold
		Septoria iridis	leaf spotting

The main mycoses on ornamental Iridaceae are caused by *Fusarium oxysporum* f. sp. g*ladioli*, *Botrytis gladiolorum*, *B. cinerea*, *Penicillium gladioli*, *Septoria gladioli*, *Puccinia iridis*, etc. (Tab. 1).

Parasite fungi on ornamental Iridaceae attack different organs of these plants, such as bulbs (corms), leaves, stems, flowers, etc.

Fusarium genus has many pathogenic species on ornamentals, but the most common is *Fusarium oxysporum*. Its sporulation is made up of conidiophores and conidia.

Some *Fusarium* species have two types of conidia (macroconidia and microconidia), while others have only macroconidia [2].

Fusarium oxysporum fungus has many formae speciales on different ornamental plants, such as *Fusarium oxysporum* f. sp. *dianthi, F. oxysporum* f. sp. *gladioli, F. oxysporum* f. sp. *tulipae, F. oxysporum* f. sp. *lilii, F. oxysporum* f. sp. *asparagi*, etc. Genetic methods are frequently used for the identification of these formae speciales.

In this way, pathogenic strains of *Fusarium oxysporum* f. sp. *dianthi* from carnation were identified by using DNA printing [3].

RAPD technique was used in order to identify pathogenic and nonpathogenic strains of *Fusarium oxysporum* f. sp. *dianthi* [7].

Genetic methods were applied for the separation of the pathogenic and nonpathogenic strains of *Fusarium* species from *Cyclamen persicum* [16].

Literature data mention that *Fusarium* species may be identified by using chemotaxonomic studies. In this way, there were identified 39 *Fusarium* species by appreciating genetic distance between them [14].

Genetic studies also showed that *Fusarium oxysporum* f. sp. *lilii* and *Fusarium oxysporum* f. sp. *tulipae* have monophylletic origin, while *Fusarium oxysporum* f. sp. *asparagi* and *Fusarium oxysporum* f. sp. *gladioli* have polyphylletic origin [13].

Cell wall degrading enzymes are the most important in *Botrytis* species attack. Enzymes secretion depends on environmental conditions. Nutritive medium's composition also influences the quantity of the enzymes. Beside extracellular enzymes, the types of active oxygen are very important in *Botrytis cinerea* plant attack [5].

Botrytis gladiolorum fungus causes gray mold and attacks leaves, stems, flowers and corms of *Gladiolus hybridus*. Brown, septate conidiophores and ovoid conidia (8.7-12.5 × 5-7.5 μm) appear on fungus' mycelium [12].

Septoria gladioli more frequently attacks young plants of *Gladiolus hybridus, Freesia hybrida, Crocus* spp. Disease symptoms appear on leaves and bulbs (corms). Fungus' sporulation is grouped in pycnidia and is made up of hyaline, filamentous pycnospores, of 23.5-67 × 2-3 μm [12].

Iridaceae smut is caused by *Urocystis gladioli*. This fungus attacks *Gladiolus hybridus*, *Crocus* spp. [1, 12].

Some authors believe that Iridaceae smut is caused by *Urocystis gladiolicola*. The symptoms appear on terrestrial parts of the plants, but the resting mycelium and spores overwinter in the corms of the attacked plants. Teliospores are round, red-brown, of 12-15 × 12-18 μm [15].

By analysing the results we obtained, it is obvious that the nutritive medium influences the growth of the parasite fungi, by modifying the colony's aspect and size.

Conclusions

According to the literature data and the research that was done, some conclusions can be drawn:

- The main mycoses on ornamental Iridaceae are caused by fungi from genera like *Fusarium, Botrytis, Penicillium, Septoria, Puccinia*, etc.;
- The most common mycoses on *Freesia hybrida* are produced by fungi like *Fusarium oxysporum* f. sp. *gladioli* (plant wilt), *Septoria gladioli* (leaf spotting), *Botrytis cinerea* (gray mold), etc.;
- *Gladiolus hybridus* plants are frequently attacked by parasite fungi like *Penicillium gladioli, Fusarium oxysporum* f. sp. *gladioli, Botrytis gladiolorum, Septoria gladioli*, etc.;
- Fungic colonies (*Fusarium oxysporum* f. sp. *gladioli, Penicillium gladioli, Botrytis cinerea*) have different characteristics according to the nutritive medium (Czapek-agar, malt-agar) that is used.

Acknowledgments: Part of this study was supported by the Romanian Ministry of Education and Research - TD 10/81/2004 CNCSIS project.

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CIUPERCI PARAZITE PE UNELE IRIDACEE ORNAMENTALE (I)

(Rezumat)

Gladiolus hybridus, Freesia hybrida, Iris germanica, Crocus sativus se numără printre cele mai comune specii de iridacee ornamentale din climatul temperat.

Principalele ciuperci parazite pe iridacee ornamentale sunt *Fusarium oxysporum* f. sp. *gladioli, Penicillium gladioli, Botrytis gladiolorum, B. cinerea, Septoria gladioli, S. iridis, Puccinia iridis, Uromyces croci* etc.

Aceste ciuperci determină boli caracteristice, precum ofilirea vasculară, putregaiul verde-albăstrui, putregaiul cenuşiu, septorioza, rugina, tăciunele etc.

Ciupercile parazite atacă diferite organe ale plantelor gazdă, precum frunzele, (tubero) bulbii, tulpinile, florile etc.

Pe baza datelor din literatură, s-au inventariat cele mai comune ciuperci descrise pe iridacee ornamentale din România.

Câteva specii de ciuperci (*Fusarium oxysporum* f. sp. *gladioli, Penicillium gladioli, Botrytis cinerea*) au fost identificate frecvent pe unele iridacee ornamentale din Grădina Botanică "Al. Borza" din Cluj-Napoca. Pentru determinarea acestor ciuperci, au fost necesare izolarea de pe planta gazdă, cultivarea pe mediu nutritiv (Czapek-agar, malţ-agar) şi examinarea microscopică.

Lucrarea de faţă reprezintă o primă contribuţie dintr-un studiu mai larg, referitor la micozele iridaceelor ornamentale din Cluj-Napoca.