

Rust Disease of Gladiolus Intercepted in Plant Quarantine

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Uredinia of a rust fungus were found on cut flower of gladiolus (*Gladiolus* sp.) imported from South Africa in November of 1997 and Italy in March of 1998 at plant quarantine inspection in New Tokyo International Airport (Narita), Japan.

These rust fungi were identified with *Uredo transversalis* Thümen on the basis of their morphology, symptoms and results of inoculation experiments because telia were not observed.

This is the first report on interception of rust disease of gladiolus caused by *Uredo transversalis* in Japan.

Symptoms of cut flowers

Symptoms of diseased gladiolus from South Africa were representatively described below because both symptoms of gladiolus from South Africa and those from Italy were typically similar.

Powdery, orange-brown uredinia of the rust fungus were found on both surfaces of the leaves. They were observed mainly on the leaves (Fig. A, B) and rarely on flower stalks enclosed by leaves. No symptom was observed apparently on flower. Uredinia were subepidermal, surrounded by the ruptured epidermis, scattered on both surfaces of the leaves. Individual sori were up to 3×0.7 mm in size. Most of sori were elongated across the leaves (Fig. C, D), especially between those parallel veins.

Number of uredinia on the diseased leaves varied from a sorus per leaf to numerous. Telia were not observed on them.

Inoculation experiments

Urediniospores were obtained from the gladiolus leaves in March of 1998 and used as inocula. Inocula were suspended in distilled water and gently brushed over both surfaces of the leaves of gladiolus (cv. Mascagni) plants. Germination rate of inocula (urediniospor-

es) was 78.4% in average at 15°C with 6 hrs in the dark by means of a hanging drop culture. Inoculated plants were placed in the dark, moist chamber at about 15°C for 1 day, then transferred to a greenhouse controlled at approximately 10–20°C. Noninoculated gladiolus (cv. Mascagni) served as a control.

Inoculation experiments were conducted in March of 1998, and the inoculated plants were observed for 2.5 months after inoculations. Results were shown in Table 1.

About 10 days after inoculation, many short linear flecks transversally appeared on the both surfaces of the inoculated leaves of gladiolus plants and ripe uredinia formation followed in the subsequent about 4 days. At first, uredinia were covered by blistered epidermis, gradually ruptured them and revealed numerous urediniospores, which made the ripe uredinia powdery, orange-brown. Uredinia developed on the inoculated leaves were up to 3×0.5 mm in size, almost similar to those on the leaves of cut flowers (Fig. H). However telia were not observed on the inoculated leaves by 2.5 months after inoculation. No symptom was observed apparently on subterranean parts.

Table 1. Pathogenicity of the rust fungus to gladiolus

Plant	Number of plant inoculated ¹⁾	Pathogenicity ²⁾
Gladiolus (cv. Mascagni)	3	3
Control	1	0

1): Plants developing 1-2 mature leaves were used as inoculation plants

2): No. of plants producing uredinia

Morphology and identification

The urediniospore dimensions of both rust fungi were shown in Table 2.

Urediniospores are borne singly on pedicels, mainly obovate (Fig. E, F) and have orange contents when they are fresh. The walls are hyaline, echinulate (Fig. G) and have six to eight scattered germ pores, which are obscure.

The dimensions of urediniospores of both rust fungi agree fairly well with the published description (Sydow, P. and Sydow, H., 1910) of *Uromyces transversalis* (Thümen) Winter which has been found to attack leaves of gladiolus cultivated in several countries mainly in Africa and Mediterranean regions (EPPO/CABI, 1997).

The dimensions of urediniospores in this species are similar to those of *Uromyces gladioli* P. Hennings which also has been found to attack gladiolus cultivated in several countries in Africa and South America (EPPO/CABI, 1992). Nevertheless, according to the description (EPPO/CABI, 1992), *U. transversalis* differs from *U. gladioli* in that the former forms the powdery orange-brown uredinia which are up to 3×0.5 mm in size and always being elongated across the leaves (Table 2).

On the other hand, the latter forms the yellow uredinia which are 0.03–1 mm in size and punctiform (EPPO/CABI, 1992). The characteristics of uredinia of our rust fungi also correspond with those of *U. transversalis* (Table 2). *Uromyces nyikensis* Sydow, occurring on wild gladiolus in Malawi (Sydow, P and Sydow, H., 1910), is a microcyclic rust fungus

Table 2. Comparison between uredinia and urediniospore of Author's rust fungi, *Uromyces transversalis*, *Uromyces gladioli* and *Uromyces nyikensis* from *Gladiolus* sp.

Rust fungi and author	Uredinia	Urediniospore dimensions		
		Length (μm)	Width (μm)	Thickness of wall (μm)
Rust from South Africa (this study)	orange-brown, being elongated across the leaf, to 3×0.7 mm	16-25 (ave. 21.4)	14-18 (ave. 16.3)	to 2.5
Rust from Italy (this study)	orange-brown, being elongated across the leaf, to 3×0.7 mm	17.5-23.8 (ave. 20.6)	13.8-17.5 (ave. 15.2)	to 2.5
<i>Uromyces transversalis</i> (Sydow & Sydow, 1910)	orange-brown, being elongated across the leaf, to 3×0.5 mm ^{a)}	14-26	13-19	to 2.5
<i>Uromyces gladioli</i> (Sydow & Sydow, 1910)	yellow, punctiform, 0.03-1 mm ^{a)}	15-22	14-20	to 2.5
<i>Uromyces nyikensis</i> (Sydow & Sydow, 1910)	microcyclic (no uredinia)	ND ^{b)}	ND	ND

a); EPPO/CABI 1992

b); not described

which aecial and uredinial stages are not known in its life cycle (Sydow, P and Sydow, H., 1910)(Table 2). Two species of *Puccinia* fungi are also known to occur on gladiolus in Europe and Africa. *Puccinia gladioli* (Duby) Cast. occurring on gladiolus in Mediterranean regions produces the small brown-black pustules (telia) which are crowded to form a crust (EPPO/CABI, 1997, Wilson, M. and Henderson, D.M. 1966). *Puccinia mccleanii* Doidge is another rust fungus of gladiolus reported from Africa (Doidge, 1941), and it also forms the dark brown pustules (telia) only. Our rust fungi are clearly distinguished from these two *Puccinia* fungi and *U. nyikensis*.

Our rust fungi were considered to be anamorph of *Uromyces transversalis* on the basis of symptoms (uredinial characteristics) on the leaves including the results of the inoculation experiments and morphology of urediniospores. Because the anamorph of *Uromyces transversalis* is known as *Uredo transversalis* Thümen, both of our rust fungi on the cut flowers were identified with *Uredo transversalis* Thümen.

Uromyces transversalis is known to occur on gladiolus cultivated in South Africa (Gorter, G.J., 1981, Doidge, 1941) and Italy (Aloj, B. and Garibaldi, A., 1977, Pisi and Bellardi, 1994).

No rust disease has been known to occur on gladiolus in Japan. *Uredo transversalis* is not also recorded in Japan. This is the first description of rust disease of gladiolus caused by *Uredo transversalis* in Japan.

Acknowledgements

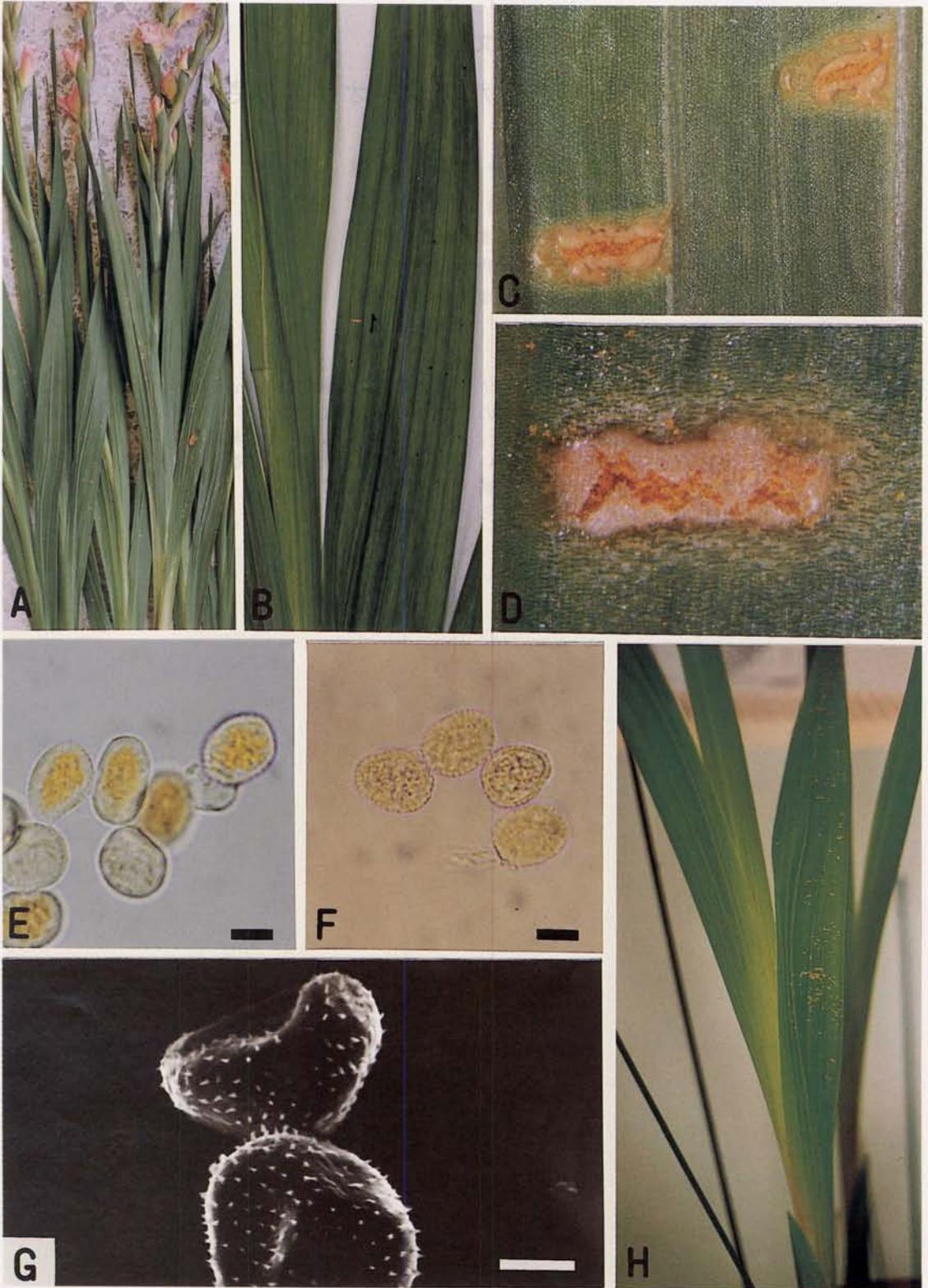
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References

- Aloj, B. and Garibaldi, A. (1977) Serious epiphytotics of *Uromyces transversalis* on *Gladiolus* in campania and attempts at control. in : manifestazioni Floricole in Versilia, Atti-Viareggio 16-18 Novembre 1977, pp.188-193. Camera di Commercio Industria Artigianato Agricoltura, Lucca, Italy.
- Doidge, E. M. (1941) South African rust fungi. IV *Bothalia*, 4, pp. 229-236
- EPPO/CABI. (1992) *Uromyces transversalis*, In ; Quarantine Pests for Europe, 1st. ed. (Ed. by Smith, I.M. *et al.*) CAB INTERNATIONAL, Wallingford, UK. pp. 657-660.
- EPPO/CABI. (1997) *Uromyces transversalis*, In ; Quarantine Pests for Europe, 2nd. ed. (Ed. by Smith, I.M. *et al.*) CAB INTERNATIONAL, Wallingford, UK. pp. 944-946.
- Gorter, G.J. (1981) IV. Annotated host list of plant diseases. 398 : pp. 41-65
- Pisi, A and Bellardi, M.G. (1994) Le ruggini delle piante ornamentali e da fiore. Floricoltura, p. 55-60.
- Sydow, P. and Sydow, H. (1910) Monographia Uredinearum, Vol. II, Genus *Uromyces*. Borntraeger, Leipzig, Germany.
- Wilson, M. and Henderson, D.M. (1966) British Rust Fungi. Cambridge Univ. Press.

Explanation of Plate I

- A** : Rusted gladiolus cut flowers imported from South Africa.
- B** : Lightly rusted leaf of gladiolus cut flowers imported from Italy (arrow is indicating the apex of the leaf)
- C** : Uredinia of rust from South Africa.
- D** : Uredinia of rust from Italy.
- E** : Urediniospores of rust from South Africa (from fresh specimen) (Bar=10 μ m).
- F** : Urediniospores of rust from Italy (from dried specimen) (Bar=10 μ m).
- G** : Echinulate surfaces of urediniospores of rust from South Africa (SEM) (Bar=5 μ m).
- H** : Symptoms of a inoculated gladiolus cv. Mascagnii plant



和 文 摘 要

植物検疫で発見されたグラジオラスのさび病

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1997年11月及び1998年3月、南アフリカとイタリアから輸入されたグラジオラス切花に同様のさび病が発見されたので、その病原菌を調査した。病徴、形態観察、接種試験の結果から、本菌はいずれも我が国では未報告のグラジオラスのさび病菌 *Uromyces transversalis* の夏孢子世代と考えら

れたので病原菌名は *Uredo transversalis* と同定された。我が国ではグラジオラスのさび病は報告されておらず、本菌も未記録である。本報は *Uredo transversalis* によるグラジオラスのさび病の本邦初記載である。