

First occurrence of gladiolus rust caused by *Uromyces transversalis* in the United States

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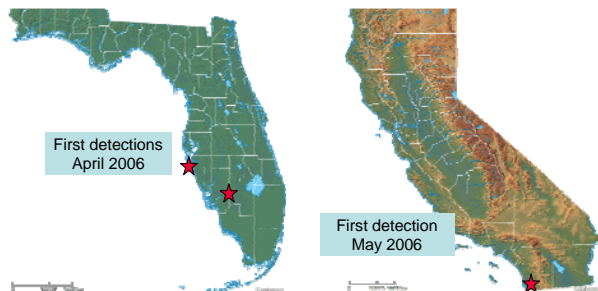
ABSTRACT - *Uromyces transversalis*, an autoecious rust pathogen of quarantine significance infecting several genera in the Iridaceae, has long been on lists of exotic pathogens threatening US agriculture (1) Both the pathogen and the host (*Gladiolus x hortulanus*) are native to southern Africa (2) After reaching the western hemisphere via South America in the early 1980's (3,4), Martinique in 1996 and central Mexico in 2004-05 (5), gladiolus rust (GR) premiered in Florida in April 2006. An interception of commercial Florida cut flowers in Hawaii prompted the discovery by trace-back. Rust was confined to two commercial farms in Manatee and Hendry counties, and in nearby residential gardens at the Manatee county site. In May 2006, gladiolus rust was also discovered in San Diego county California. Efforts to contain and eradicate the pathogen included applications of triazole and strobilurin fungicides, precautions in the packing house to insure no foliage with rust were packed, roguing and early removal of the crop and all volunteer plants, and prolonged area-wide surveys and host free periods during the summer to reduce or eliminate live inoculum. Despite these efforts, GR reappeared at the Manatee county FL site in February 2007, and at the Hendry county FL site about one month later. The pathogen also reappeared in San Diego county CA in June 2007. A national management plan for exclusion and eradication drafted by USDA Emergency and Domestic Programs continues to provide the framework to minimize the impact of GR in the US.

Facts about Gladiolus Rust

- Direct crop damage from rust can be considerable, and quarantines can restrict cut flower sales to only local markets
- Primary hosts are *Gladiolus*, *Crocossmia*, *Watsonia*, *Tritonia*, *Anomatheca*, and *Melasmaerula*
- Only uredinial and telial stages are known, and the telial stage appears to be non-functional. There are no alternate hosts known.
- Best infection conditions are 16-23°C and about 12 hours of leaf wetness
- Symptoms appear in >20 days at 10°C and in 8-10 days at 25°C
- Uredinia form mostly on leaves, but will form on bracts under heavy and prolonged disease pressure
- It is unlikely that GR will become endemic outside of USDA Plant Hardiness Zone 10 and possibly Zone 9 because of hard winter freezes which dictate long host-free periods between crops

Rationale for attempting eradication

- Disease is very limited geographically in the US at present
- Host range is limited to only six genera in the Iridaceae
- A 90 day host free period can be achieved economically to permit depletion of inoculum. Urediniospores are thought to be non-infectious after about 60-70 days.
- Cost of weekly fungicide applications is high and profit margins for cut gladiolus grown in the US are slim.
- Even if eradication ultimately fails, delayed onset of disease reduces production costs considerably, and provides time for breeding resistant varieties.



Where does GR inoculum come from? - Source(s) of the inoculum that initiated GR in Florida and California remain unknown. Nearest known sources are in seven contiguous states of Mexico southwest of Mexico City (<http://www.pestalert.org/oprDetail.cfm?oprID=138&keyword=Uromyces%20transversalis>) which first reported GR in 2004 and Martinique in the eastern Caribbean where the disease has been spotty since 1996. Specific surveys for gladiolus rust were conducted in Florida in 2004 and 2005 with no detections. Surveys were prompted by the first reports of GR in Mexico in 2004, and repeated interceptions of GR at the Mexican border and in commercial shipments from Brazil in that time frame. In recent years, many rust pathogens apparently have made transoceanic trips to arrive in the US: sugarcane orange rust (*Puccinia kuehni*) in 2007, boxwood rust (*Puccinia buxi*) in 2006 and under eradication, veronica rust (*Puccinia veronicae-longifoliae*) in 2005, soybean rust (*Phakopsora pachyrhizi*) in 2004, cineraria / English daisy rust (*Puccinia lagenophorae*) in 2001, daylily rust (*Puccinia hemerocallidis*) in 2000, lemongrass rust (*Puccinia nakanishiki*) in 1985, chrysanthemum white rust (*Puccinia horiana*) starting in 1991 and repeatedly introduced and eradicated since, bromeliad rust (*Puccinia tillandsiae*) in 1980, and sugarcane brown rust (*Puccinia melanocephala*) in 1978. Recognizing that rusts have high damage potential and are difficult to eradicate once introduced, fourteen of the twenty fungi named on the USDA-ARS Invasive and Emerging Fungal Pathogens list are rust pathogens. (<http://nt.ars-grin.gov/sbmlweb/fungi/diagnosticfactsheets.cfm>)



Captions

- Fig. 1. Typical commercial gladiolus production field
 Fig. 2. Symptoms of early infection (approx. 2 weeks old)
 Fig. 3. Symptoms of later infection (approx. 4 weeks old)
 Fig. 4. Close-up view of transverse uredinia (across the leaf veins) that are characteristic of gladiolus rust (leaf is horizontal)
 Fig. 5. Urediniospores (120x)
 Fig. 6. Teliospores (120x) (no known function)
 Fig. 7. Extent of foliar necrosis on a susceptible variety. This much damage can result in no marketable flowers and weak corms.
 Fig. 8. Telia can form around uredinia on older infected foliage.

References: (1)Stevenson, J. A. Page 82 in: Foreign Plant Diseases, USDA Federal Horticultural Board and Bureau of Plant Industry, Government Printing Office, Washington, D.C. 1926. (2) IMI Distribution Map of Plant Diseases #722, *Uromyces transversalis*. 1996. (3) Pitta, G. P. B., *et al.* Biologica 47: 323-328, 1981. (4) Hernandez, J.R., and Hennen, J.F. Sida 20: 313-338, 2002. (5) Rodriguez-Alvarado, G., *et al.* Plant Dis. 90:687, 2006.

