EPPO Datasheet: *Fusarium foetens*

Last updated: 2023-10-17

IDENTITY

Preferred name: *Fusarium foetens*
Authority: Schroers & al.
Taxonomic position: Fungi: Ascomycota: Pezizomycotina: Sordariomycetes: Hypocreomycetidae: Hypocreales: Nectriaceae
Common names: fusarium wilt of Hiemalis begonia
view more common names online...
EPPO Categorization: A2 list
view more categorizations online...
EPPO Code: FUSAFO

more photos...

Notes on taxonomy and nomenclature

*Fusarium foeten*s is a sister taxon of the *Fusarium oxysporum* species complex (Schroers *et al*., 2004). The presence of microconidia borne in polyphialides and monophialides on long and short conidiophores in the aerial mycelium distinguishes it from *F. oxysporum* which has only monophialides on short conidiophores.

HOSTS

Fusarium wilt is most severe on the Hiemalis begonias (*Begonia* × *hiemalis* or begonia elatior hybrids) (Brand & Weinberg, 2005; Elmer, 2008; Hamelink &van Noort, 2009). Other begonia species have shown less susceptibility or complete immunity in artificial inoculation tests. Symptoms on Lorraine begonia (*Begonia* ×*cheimantha* 'Kardinal') and Tuberous begonia (*Begonia* × *tuberhybrida* 'Champagner' were delayed when inoculated, but the plants eventually died (Brand & Wienberg, 2005). Of nine Rex begonia (*B. rex*) cultivars tested, two varieties ('Hurricane Bay' and 'White Caps') had significant stunting compared to uninoculated controls, but no wilt appeared (Elmer, 2008). No wilt symptoms or stunting was detected on angelwing begonias (*B. coccinea* Hook), or wax begonias (*Begonia* × *semperflorens-cultorum*) when tested.

Lamprecht & Tewoldemedhin (2017) isolated *F. foetens* from wilting rooibos (*Aspalathus linearis*) seedlings, grown for tea production in South Africa. Identification was confirmed via matched sequences of EF-alpha gene, and pathogenicity tests show that the rooibos plant is another host for *F. foetens*.

Liu *et al*. (2023) isolated *F. foetens* from wilting potatoes and completed Koch postulates showing potato to be another host.

A few other asymptomatic hosts have been identified including maize, on which it affects the kernels, (González-Jartín *et al.*, 2018) and coastal heath plants that were not identified (Summerell *et al.*, 2011).

During artificial inoculation tests, the following plants were shown to be symptomatic experimental hosts:

- - *Begonia* × *cheimantha* 'Kardinal', and *Begonia* × *tuberhybrida* 'Champagner' (Brand & Wienberg, 2005)
  - *Begonia rex* cultivars 'Hurricane Bay' and 'White Caps' (Elmer, 2008).
  - Bell pepper (*Capsicum annuum* var. *grossum*) (Amobonye *et al.*, 2021).
  - Cyclamen (*Cyclamen persicum*, Schroers *et al* 2004).
  - Cayenne pepper (*Capsicum annuum* var. *longum*, Amobonye *et al*., 2021).
  - Lupin *Lupinus angustifolius* (Lamprecht & Tewoldemedhin, 2017).
  - Tomato (*Solanum lycopersicum*) (Amobonye *et al*., 2021).

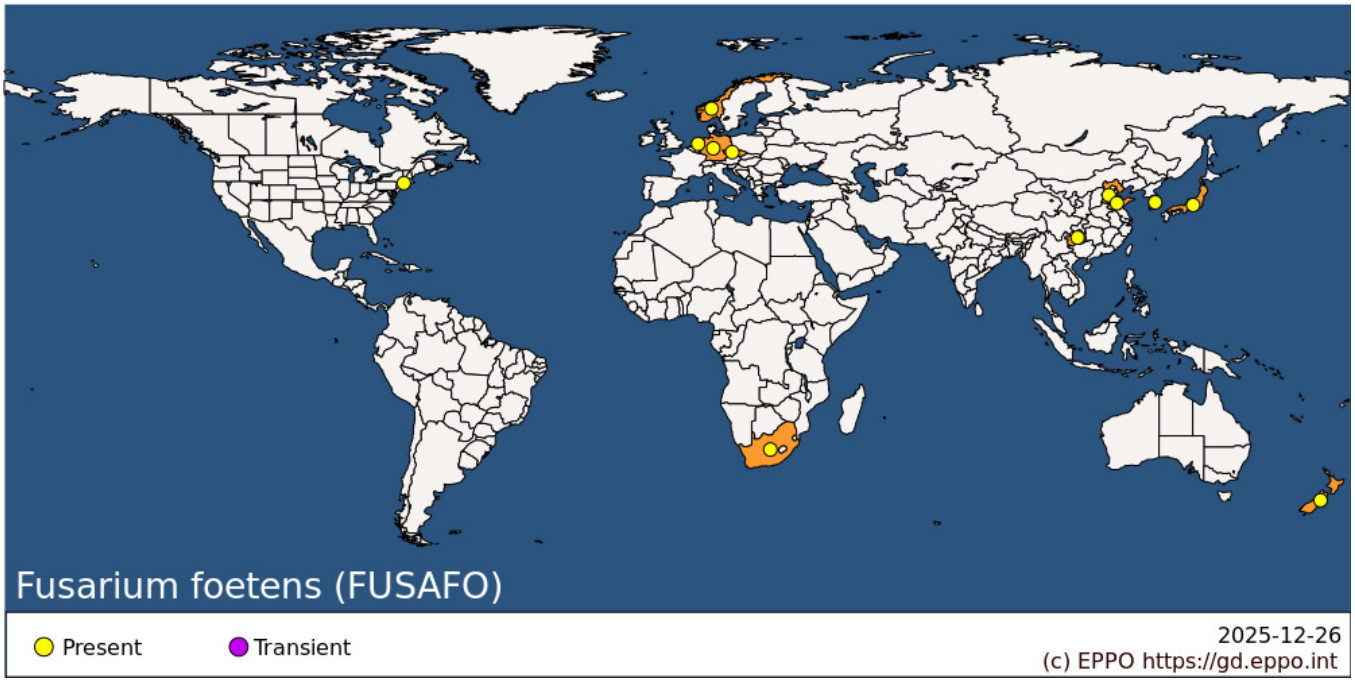
Host list:

Aspalathus linearis, Begonia x hiemalis, Lavandula angustifolia, Solanum tuberosum

GEOGRAPHICAL DISTRIBUTION

Fusarium foetens was first identified causing disease in *Begonia* × *hiemalis* in the Netherlands in 2001 (Schroers *et al.*, 2004). The fungus quickly spread and was found in Germany in 2002 (Neubauer & Nirenberg, 2002) and the USA in 2003 (Elmer *et al*., 2004), then to Japan in 2006 (Sekine *et al.*, 2008), and to Belgium and Canada in 2010 (Tian *et al*., 2010). The pathogen was intercepted in England (Jones & Baker 2007) and has been eradicated in France in 2007 (Saurat *et al*., 2013).

The fungus was isolated from diseased rooibos (*Aspalathus linearis)* in South African nurseries (Lamprecht & Tewoldemedhin, 2017) and from garden soils near Durban, South Africa (Amobonye *et al*., 2021). In 2023 *F. foetens* was isolated from wilting potato (*Solanum tuberosum*) plants in Laiyang city, China (Liu *et al*., 2023). Summerell *et al.* (2011) reported on two isolates of *F. foetens* isolated from coastal heath vegetation from the Cape Arid National Park in Western Australia, Australia. *F. foetens* could be isolated from 75% of raw processed beef, chicken, and fish meat samples obtained in markets in Iraq (Abedzaid *et al*., 2014). One unconfirmed Indian publication reported a *F. foetens*-like culture from a saltworks in Villupuram Tamil Nadu State, India (Panchal *et al*., 2022). In Panchal *et al.* (2022) report, the isolates were identified using morphology only and no molecular confirmation was provided.



EPPO Region: Czechia, Germany, Netherlands, Norway
Africa: South Africa
Asia: China (Guizhou, Hebei, Shandong), Japan (Honshu), Korea, Republic of
North America: Canada (Ontario), United States of America (Connecticut)
Oceania: New Zealand

BIOLOGY

Since no teleomorph is known for *F. foetens*, it is concluded that the fungus spreads asexually. On *Begonia* × *hiemalis*, the infective propagules are microconidia, macroconidia, and chlamydospores. The infecting structure in all propagules is the mycelium which invades roots and colonizes the basal stems and vascular tissue. The fungus eventually sporulates profusely on dying blackened stems. Heavily colonized stems attract fungus gnats which can aid in spread of the fungus to healthy plants. The pathogen can also move in irrigation water and studies found that less than 100 conidia/mL was sufficient to lead to disease on *Begonia* × *hiemalis* (Wohanka, 2003; Elmer, 2008).

On Potato dextrose agar (PDA), the distinct odour of the colonies is pungent and irritating, but less distinct on synthetic nutrient-poor agar (SNA) (Schroers *et al*., 2004; Tschöpe e*t al*., 2007). The name, '*foetens*', meaning fetid, stinking, or smelly in Latin refers to this. *F. foetens* is easily distinguished from another Fusarium stem rot disease reported in the 1990s that also attacked Hiemalis begonias. That disease, caused by *Fusarium begoniae* (Nirenberg & O'Donnell, 1998), caused a dry rot canker on stems of begonias, and was not associated with root damage or vascular discoloration.

Some putative isolates of *F. foetens* have been reported to be toxigenic (Abedzaid & Abd Al-Reda, 2014), but their identification was based on matching ITS sequences and not by the more accepted and informative EF-alpha gene sequences. González-Jartín *et al.* (2019) isolated a strain of *F. foetens* from maize and reported that it produced the mycotoxins beauvericin and fusaric acid. O'Donnell *et al.*, (2009) reported no detectable level of fumonisin and moniiformin in their strain (NRRL 31852). Isolates may vary in their toxigenicity.

Results from China and South Africa suggest chlamydospores might play an important role in survival and persistence in soil during temperature extremes (Amobonye *et al*., 2021; Li *et al.*, 2023). The role of the mycotoxins produced by *F. foetens* in pathogenicity is unclear (González-Jartín *et al.*, 2019). The fungus produces an array of volatile sesquiterpenes and cyclohexane derivatives which can be useful in identification (Tschöpe *et al*., 2007), but their role in its biology and/or pathogenicity is not clear. Elmer (2008) hypothesized these metabolites might attract fungus gnats and aid in the pathogens' dissemination.

DETECTION AND IDENTIFICATION

Symptoms

Symptoms on *Begonia* × *hiemalis* begonias appear as a very slight chlorosis in the dark green foliage followed by vein clearing and stunting. Root rot usually begins before the onset of foliar symptoms. As the disease progresses, basal stems begin to discolor. Wilting and vascular discoloration is also common. Dying stems are frequently covered with orange sporodochia that reveal microconidia and macroconidia when examined microscopically. In severe cases, the disease can cause mortality in less than two weeks. On rooibos, *F. foetens* causes symptoms such as damping off and root rot. On potato, *F. foetens* caused typical symptoms of wilt.

Morphology

Colonies grown on PDA develop white aerial mycelium while undersides of the agar dish can be variable depending on the quality of light during incubation. At 21 °C, colonies expand about 4.8 mm/day. When sub-cultured for 10-14 days on SNA amended with 1 x 3 cm filter papers (Nirenberg, 1976), short or long conidiophores bearing microconidia in monophialides or less frequently polyphialides are produced. Microconidia are one cell (rarely 2 to 3 celled) ovoidal to ellipsoidal (averaging 6.5 µm × 2.8 µm). Pale to light orange sporodochia are abundant on SNA and bear macroconidia in monophialides. Macroconidia are mostly 3 septate, slightly curved with the two central cells almost straight and average 34 µm × 4.4 µm. Chlamydospores are rare or abundant, globose, smooth or warted, and borne on terminal conidiophores, but can be intercalary in the mycelium. Chlamydospores are 7–13 µm × 7–11 µm (Schroers *et al.*, 2004).

Detection and inspection methods

On Hiemalis begonia, the pathogen may not cause visible symptoms on young seedlings or cuttings whereas on rooibos seedlings a damping off/root rot was apparent. Molecular tools are available for detection in asymptomatic tissue (de Weerdt *et al*., 2006). Once symptoms are noted, affected tissue should be surface-disinfested with 70% ethanol or 10 % household bleach, thoroughly rinsed with water, and placed on selective agar such as Peptone PCNB (Laurence *et al*., 2012) or Komada's selective medium (Komada, 1975). Sub-cultures arising from single spores should be grown on SNA agar amended with pieces of sterile filter paper for 10-14 days under 12 hr. photoperiods at 20-23 °C and microscopically examined under 100x and 400 x (Schroers *et al*. 2004).

F. foetens closely resembles members of the *F. oxysporum* species complex (FOSC) except for two distinguishing

characteristics. The presence of microconidia borne in polyphialides and monophialides on long and short conidiophores in the aerial mycelium. The strong pungent colony odour detectable on cultures grown on PDA can be useful for identification (Schroers *et al*., 2004; Tschöpe e*t al*., 2007). Confirmation using genotyping should also be done by sequencing partial fragments of the Ef? and ?-tubulin gene and blasting the sequences in Fusarium ID database (Geiser *et al.,* 2004) or GenBank. More specific molecular probes have been designed by Huvenne *et al.* (2011) for real-time PCR detection and confirmation.

For morphological and molecular identification see the EPPO Diagnostic protocol PM 7/111 (EPPO, 2013).

PATHWAYS FOR MOVEMENT

F. foetens was shown to spread short distances by irrigation water (Wohank, 2003). Ebb and flow systems commonly used in *Begonia* × *hiemalis* greenhouse operations provided rapid means to spread. Inoculum levels as low as 100 conidia $mL^{?1}$ could lead to disease, but filtration and sanitation products such as chlorine dioxide and H_2O_2 disinfectants are effective in killing the spores. (Wohanka *et al*. 2005; Elmer, 2008). In Connecticut, fungus gnats (*Bradysia* spp.) were implicated as vectors for short distances. Long distance spread is likely due to infested plant material. Within the EPPO region, *F. foetens* was presumed to be introduced to the Netherlands (Schroers *et al*., 2004) and from there spread to other countries presumably on infested *Begonia* × *hiemalis* cuttings. However, since *F. foetens* has since been found to cause root diseases on plants other than begonias that were not associated with begonia production (Lamprecht & Tewoldemedhin, 2017; Liu *et al*., 2023), the origin of the pathogen is not clear. The fungus was also isolated from soils (Amobonye *et al.*, 2021; Panchal *et al*., 2022) and from asymptomatic plants (González-Jartín *et al*., 2018; Laurence *et al*., 2012) which could suggest a diverse biology and possibly diverse genetic origins.

PEST SIGNIFICANCE

Economic impact

F. foetens was first reported to cause severe damage to various *Begonia* × *hiemalis* cultivars and was highly destructive for growers. Economic data specific to *Begonia* × *hiemalis* losses were not available, but begonia sales, in general, reached over 27 million USD in 2019 in the USA (Anon 2019). Since other *Begonia* species are significantly less or not susceptible, no economic impact has been reported on these. In South Africa, *F. foetens* lead to damping off/root rot in nurseries producing rooibos seedlings and over 50% losses were reported in affected nurseries. Economic data are not available. In Laiyang city, China, *F. foetens* was one of several *Fusarium* species capable of causing Fusarium wilt on potato. Although the losses specific to *F. foetens* versus the other species of *Fusarium* is difficult to determine, potato losses due to Fusarium wilt and result in 30 to 78 % losses in certain areas in China (Xia *et al.*, 2022).

Control

Management techniques for *F. foetens* depend on the host. Strategies should always be multifaceted and integrate cultural controls, biological controls, and genetic resistance when possible. Chemical products such as fungicides have not been explored in begonia production but were examined on potato.

Begonia growers should ensure all incoming propagation material is disease free. If material is suspected to be infected, it should be segregated to make sure it remains asymptomatic. If available, molecular tests could be used to assess the possibility that material is infested. Use of clean potting soil, pots, and trays is very important. If trays or pots are reused, they should be disinfected. Since irrigation water can be a source of inoculum, Wohanka *et al.* (2005) found water filtration and the use of chlorine dioxide applied at 1.5–1.7 ug $mL^{?1}$ eliminated *F. foetens* from recycled water. Several hydrogen peroxide products were very effective in disinfesting *F. foetens* from irrigation sources (Elmer, 2008). Adding composts protected begonias in Germany (Van der Gaag *et al*., 2007) and rooibos in South Africa (Lamprecht & Tewoldemedhin, 2017). In potato fields in China, chemical fungicides, crop rotation, and use of tolerant cultivars is recommended, however, the authors cautioned that Fusarium wilt is difficult to manage (Liu *et al*., 2023).

In relation to biological control in Ontario Canada, Tian *et al.* (2012) examined five laboratory *Bacillus subtilis* strains along with biocontrol agents such as *Streptomyces lydicus*, *Streptomyces griseoviridis*, *Trichoderma harzianum*, *Gliocladium catenulatum* for efficacy in suppressing *F. foetens* on Hiemalis begonias. When applied as soil drenches before inoculation, all biocontrol agents significantly reduced the disease, increased biomass, and chlorophyll content when compared to untreated inoculated controls (Tian *et al.*, 2013).

Genetic resistance is also an important aspect. Although most Hiemalis begonia cultivars are susceptible, tolerance has been reported in 'Dragone' and' Kristy' (Huvenne *et al.*, 2011), and 'Rainbow Spectrum Camilla' (Tian *et al.*, 2012). No reports of resistance to *F. foetens* in rooibos plants or potato cultivars have been made, but varieties of each plant that show tolerance to *F. oxysporum* would likely be resistant to *F. foetens*. This information needs to be validated.

Phytosanitary risk

F. foetens continues to pose a global threat to the *Begonia x hiemalis* industry and the risk to Begonia production is high. This pest has the potential to be spread via trade. Pathogenicity tests on begonia with isolates of *F. foetens* from Australia, China, European countries, India, the Middle East, South Africa, and the USA are needed to determine whether these isolates are pathogens or non-pathogenic isolates. Potential risks have been highlighted by more recent reports noting that *F. foetens* may be a common inhabitant of agricultural soils and natural landscapes in different countries (Lamprecht & Tewoldemedhin, 2017; Laurence *et al*., 2012; Li *et al*., 2023; Panchal *et al.*, 2022). Until a more comprehensive multigene phylogenetic analysis is conducted with isolates of *F. foetens* along with cross pathogenicity tests with Hiemalis begonias, the risk of continued re-introduction remains high.

PHYTOSANITARY MEASURES

When *F. foetens* was discovered in the EPPO region, the Netherlands conducted a PRA (Van der Gaag & Van Raak, 2010) and regulated it for propagation material. It has been recommended for regulation as a quarantine pest by EPPO in 2007 and was deregulated in the Netherland in 2011 (Van der Gaag *et al.*, 2017). *F. foetens* has since been prioritized by the Netherlands Food and Consumer Product Safety Authority as a pathogen which has a strong likelihood of establishment (Van der Gaag *et al.*, 2017). Continued monitoring for symptoms is necessary. Phytosanitary Measures have been identified by EPPO (2007). These incudes that plants for planting of *Begonia x hiemalis* and *Begonia x cheimantha* come from a pest-free area or a pest-free place of production. An alternative option could be that plants for planting are produced in a pest-free production site. Careful inspection should be made for all propagative material being moved. Given the difficulty in observing visual symptoms in propagative material or small transplants, the use of molecular probes could be highly beneficial if this is economically feasible.

REFERENCES

Abedzaid B & Abd Al-Reda S (2014) Morphological and characteristic diagnosis of *Fusarium foetens* and the possibility of production mycotoxins. Al-Kufa University *Journal for Biology* **6**(1) https://journal.uokufa.edu.iq/index.php/ajb/article/view/8176 [last accessed May 2023].

Amobonye A, Bhagwat P, Ranjith D, Mohanlall V & Pillai S (2021) Characterisation, pathogenicity and hydrolytic enzyme profiling of selected *Fusarium* species and their inhibition by novel coumarins. *Archives of Microbiology* **203,** 3495-3508.

Anonymous (2019) USDA, NASS, Census of Horticultural Specialties.

Brand T & Wienberg J (2005) Anfälligkeit verschiedener Begonien gegenüber *Fusarium foetens*. *Gesunde Pflanzen* **57,** 27-29.

de Weerdt M, Zijlstra C, van Brouwershaven IR., van Leeuwen GCM, de Gruyter J & Kox LFF (2006) Molecular detection of *Fusarium foetens* in Begonia. *Journal of Phytopathology* **54**, 694–700.

Elmer WH (2008) Preventing spread of Fusarium wilt of Hiemalis begonias in the greenhouse. *Crop Protection* **27**,

1078-1083.

Elmer WH, Vossbrinck C & Geiser DM (2004) First report of a wilt disease of Hiemalis begonias in the US caused by *Fusarium foetens*. *Plant Disease* **88**, 1287.

EPPO (2007) Report of a Pest Risk Analysis. *Fusarium foetens*, EPPO, Paris. Available at https://pra.eppo.int/pra/55e1e2fb-b763-4ed0-b53b-0c20b57576e8

EPPO (2013) EPPO Standards. Diagnostics. PM 7/111 (1) *Fusarium foetens. EPPO Bulletin* **43**, 68-80. https://doi.org/10.1111/epp.12021

Geiser DM, del Mar Jiménez-Gasco M, Kang S, Makalowska I, Veeraraghavan N, Ward TJ, Zhang N, Kuldau GA & O'Donnell K (2004) FUSARIUM-ID v. 1.0: a DNA sequence database for identifying *Fusarium*. *European Journal of Plant Pathology* **110**, 473-479.

González-Jartín JM, Alfonso A, Sainz MJ, Vieytes MR, Aguín O, Ferreiroa V & Botana LM (2019) First report of *Fusarium foetens* as a mycotoxin producer. *Mycotoxin Research* **35**, 177-186.

Hamelink R & van Noort F (2009) Toetsing resistentie tegen *Fusarium foetens* in Begonia. Projectnummer 3242063500 Wageningen UR Glastuinbouw, Bleiswijk 458300. https://www.wur.nl [last accessed July 2023].

Huvenne H, Debode J, Maes M & Heungens K (2011) Real-time PCR mediated monitoring of *Fusarium foetens* in symptomatic and non-symptomatic hosts. *European Journal of Plant Pathology* **131**, 705-717.

Jones DR & Baker RH (2007) Introductions of non?native plant pathogens into Great Britain, 1970–2004. *Plant Pathology* **56,** 891-910.

Komada H (1975) Development of a selective medium for quantitative isolation of *Fusarium oxysporum* from natural soil. *Review of Plant Protection Research* **8,** 114-124.

Lamprecht SC & Tewoldemedhin YT (2017) *Fusarium* species associated with damping-off of rooibos seedlings and the potential of compost as soil amendment for disease suppression. *South African Journal of Botany* **110**, 110-117.

Laurence MH, Burgess LW, Summerell BA & Liew EC (2012) High levels of diversity in *Fusarium oxysporum* from non-cultivated ecosystems in Australia. *Fungal Biology* **116**, 289-297.

Liu L, Jin X, Lu X, Guo L, Lu P, Yu H & Lv B (2023) Mechanisms of surfactin from *Bacillus subtilis* SF1 against *Fusarium foetens*: A novel pathogen inducing potato wilt. *Journal of Fungi* **9**(3), 367.

Neubauer C & Nirenberg HI (2002) Neue Fusarium-Erkrankung bedroht Begonien-Anbau. *Gärtnerbörse* **102** 50-52.

Nirenberg HI (1976) Untersuchungen über die morphologische und biologische Differenzierung in der *Fusarium*-Sektion *Liseola. Mitteilungen aus der Biologischen Bundesanstalt für Land-und Forstwirtschaft Berlin-Dahlem* **169**, 1–117.

Nirenberg HI & O'Donnell K (1998) New *Fusarium* species and combinations within the *Gibberella fujikuroi* species complex. *Mycologia* **90,** 434–458.

O'Donnell K, Gueidan C, Sink S, Johnston PR, Crous PW, Glenn A, Riley R, Zitomer NC, Colyer P, Waalwijk C & van der Lee T (2009) A two-locus DNA sequence database for typing plant and human pathogens within the *Fusarium oxysporum* species complex. *Fungal Genetics and Biology* **46**, 936-948.

Panchal S, Murali TS, Suryanarayanan TS & Sanyal K (2022) Hypersaline fungi as a source of potentially active metabolites against pathogenic *Candida* species. *Czech Mycology* **74**(1), 93-101.

Saurat C, Fourrier C, Wilson V, Casset C & Ioos R (2013) First report of *Begonia elatior* wilt disease caused by *Fusarium foetens* in France. *Plant Disease* **97**, 144-144.

Schroers H-J, Baayen RP, Meffert JP, de Gruyter J, Hooftman M & O'Donnell K (2004) *Fusarium foetens*, a new species pathogenic to begonia elatior hybrids (*Begonia* × *hiemalis*) and the sister taxon of the *Fusarium oxysporum* species complex. *Mycologia* **96**, 393-406.

Sekine T, Kanno H & Aoki T (2008) Occurrence of leaf and stem rot caused by *Fusarium foetens* on begonia elatior hybrids (*Begonia x hiemalis*). *Japanese Journal of Phytopathology* **74**, 164-166.

Summerell BA, Leslie JF, Liew EC, Laurence MH, Bullock S, Petrovic T, Bentley AR, Howard CG, Peterson SA, Walsh JL & Burgess LW (2011) *Fusarium* species associated with plants in Australia. *Fungal Diversity* **46**, 1-27.

Tian XL & Zheng Y (2013) Compost teas and reused nutrient solution suppress plant pathogens in vitro. *HortScience* **48**, 510-512.

Tian XL, Dixon M & Zheng Y (2010) First report of Hiemalis begonias wilt disease caused by *Fusarium foetens* in Canada. *Plant Disease* **94**, 1261.

Tian XL, Dixon M & Zheng Y (2012) Susceptibility of various potted begonias to *Fusarium foetens*. *Canadian Journal of Plant Pathology* **34**, 248-254.

Tschöpe B, Hey M, Wohanka W & Hennig F (2007) Characterisation and identification of *Fusarium foetens*, causative agent of wilting and stem rot of *Begonia elatior* hybrids (*Begonia x hiemalis*) by its volatile compounds. *European Journal of Horticultural Science* **72**, 152-157.

Van der Gaag DJ, Van Noort FR, Stapel-Cuijpers LHM, De Kreij C, Termorshuizen AJ, Van Rijn E, Zmora-Nahum S & Chen Y (2007) The use of green waste compost in peat-based potting mixtures: Fertilization and suppressiveness against soilborne diseases. *Scientia Horticulturae* **114**(4), 289-297.

Van der Gaag DJ & Raak M (2010) PRA *Fusarium foetens*, April 2010, Plant Protection Service, the Netherlands.

Van der Gaag DJ, Van Leeuwen GC, Loomans AJ, Potting RP & Verhoeven JT (2017) Prioritizing risks for plant health in the Netherlands: a method to rank pests according to their probability of introduction. *EPPO Bulletin* **47**, 69-78.

Wohanka W (2003) Untersuchungen zur Ausbreitung einer neuen Fusariose an Elatiorbegonien bei Anstaubewässerung mit Langsamfiltration. *Mitteilungen der Deutschen Phytomedizinischen Gesellschaft* **33**, 69–70.

Wohanka W, Molitor HD & Weichlein D (2005) Verhinderung der Krankheitsausbreitung bei Ebbe/Flutbewässerung mittels Wasserdesinfektion durch Chlordioxid. Bericht über die wissenschaftliche Betreuung des Forschungs- und Entwicklungsvorhabens im Agrarbereich für Umweltschutz (03UM002). http://download.ble.de/03UM002_W.pdf

Xia SY, Niu ZM, Li QQ, Zhang LJ & Sheng WM (2022) Research progress and control measures of *Fusarium* wilt of potato. *Heilongjiang Agricultural Sciences* **2**, 89–94.

ACKNOWLEDGEMENTS

This datasheet was prepared in 2023 by Wade Elmer, The Connecticut Agricultural Experiment Station (USA). His valuable contribution is gratefully acknowledged.

How to cite this datasheet?

EPPO (2025) *Fusarium foetens*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int

Datasheet history

This datasheet was first published online in 2023. It is maintained in an electronic format in the EPPO Global

Database. The sections on 'Identity', ‘Hosts’, and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

Co-funded by the
European Union