

# EPPO Datasheet: *Venturia nashicola*

Last updated: 2020-12-18

## IDENTITY

**Preferred name:** *Venturia nashicola*

**Authority:** Tanaka & Yamamoto

**Taxonomic position:** Fungi: Ascomycota: Pezizomycotina:  
Dothideomycetes: Venturiales: Venturiaceae

**Common names:** scab of Chinese pear, scab of Japanese pear  
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**EU Categorization:** A1 Quarantine pest (Annex II A)

**EPPO Code:** VENTNA



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## Notes on taxonomy and nomenclature

Tanaka & Yamamoto (1964) first described *V. nashicola* as a pathogen of Asian pear scab based on comparative studies on morphological, cultural and pathological characteristics of Japanese isolates. Although this species was regarded as a synonym of *V. pyrina* (Sivanesan, 1977), Ishii & Yanase (2000) concluded that *V. nashicola* is distinct from *V. pyrina*. Although ascospore formation was observed in a cross between Japanese and Chinese pear isolates, neither asci nor ascospores were produced when Japanese or Chinese pear isolates were crossed with those from European pear. Phylogenetic studies using rDNA-ITS,  $\beta$ -tubulin, elongation factor 1 $\alpha$ , and endo-polygalacturonase genes supported taxonomic separation of *V. nashicola* from *V. pyrina* (Zhao *et al.*, 2012, 2016). Whole genome sequences were analysed (Johnson *et al.*, 2019) and comparative research indicated the close relationship of *V. nashicola* with *V. pyrina*, but they were in separate phylogenetic clades (Prokchorchik *et al.*, 2020). In the Republic of Korea, *V. nashicola* was also found to be the pathogen causing scab of pear (Cho *et al.*, 1985).

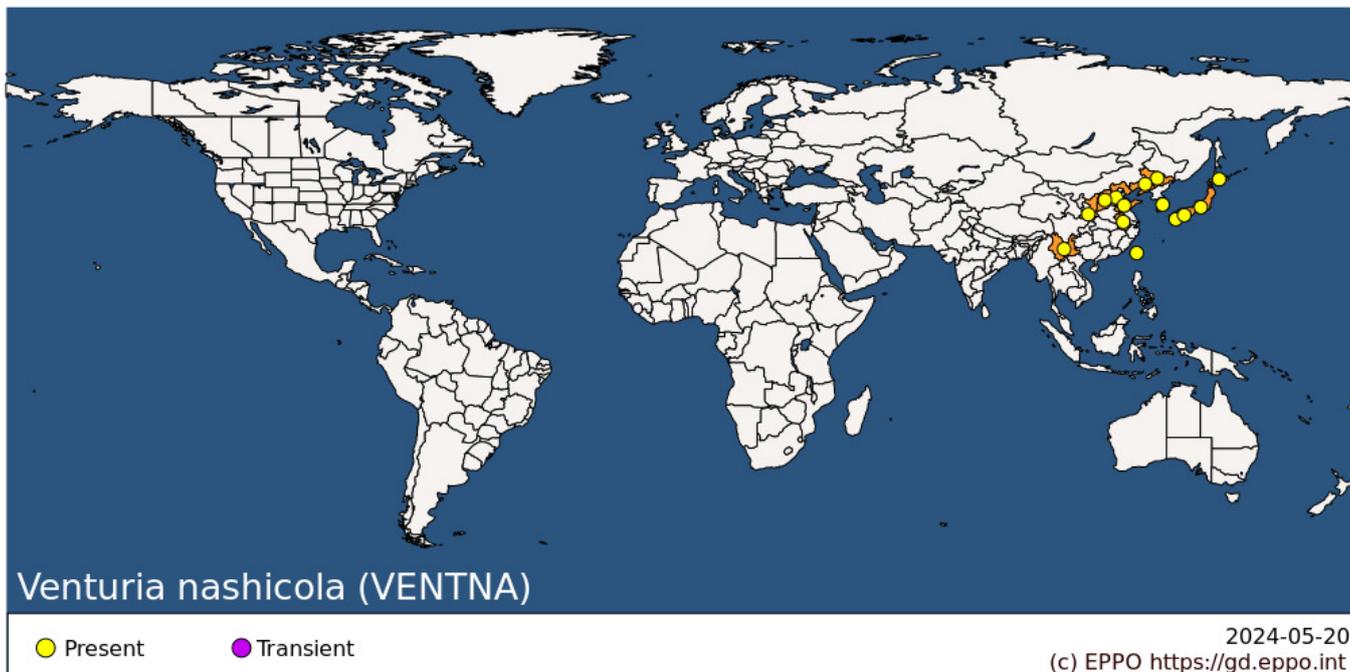
## HOSTS

The principal hosts are Asian pears ('nashi') including Japanese pear (*Pyrus pyrifolia* var. *culta*) and Chinese pears (*P. bretschneideri*, and *P. ussuriensis*). *V. nashicola* has also been reported on various wild *Pyrus* spp. such as *P. betulifolia* (hokushimamenashi and manshumamenashi), *P. aromatica* (iwateyamanashi), *P. vilis* (Ishii *et al.*, 2002). However, these wild species are not widely distributed and are not a significant reservoir of the pathogen. Pathological specialization has been found in *V. nashicola* and 7 races have been identified so far (Ishii *et al.*, 2002; Ishii *et al.*, in press). European pear (*P. communis*) has been shown not to be a host (Tanaka & Yamamoto 1964; Ishii & Yanase 2000; Ishii *et al.*, in press). Asian pears are grown in the EPPO region, but at a much smaller scale than European pear.

**Host list:** *Pyrus betulifolia*, *Pyrus bretschneideri*, *Pyrus calleryana*, *Pyrus pyrifolia* var. *culta*, *Pyrus pyrifolia*, *Pyrus ussuriensis* var. *aromatica*, *Pyrus ussuriensis* var. *hondoensis*, *Pyrus ussuriensis*

## GEOGRAPHICAL DISTRIBUTION

*V. nashicola* is indigenous to Eastern Asia and has no history of wider spread to new areas.



**Asia:** China (Anhui, Hebei, Jilin, Liaoning, Shaanxi, Shandong, Shanxi, Yunnan), Japan (Hokkaido, Honshu, Kyushu, Shikoku), Korea, Republic, Taiwan

## BIOLOGY

The fungus overwinters in infected leaves on the orchard floor and forms ascospores in a pseudothecium in the following spring. The fungus also overwinters in the inner tissues of bud scales on the tree, resulting in the production of conidia. The ascospores and conidia thus formed play an important role in the primary infections. The discharge of ascospores and the dispersal of conidia occur mainly in rainy periods. The incubation period of the fungus in leaves and fruit is influenced by weather conditions and is 3-4 weeks or even longer. The fungus repeats secondary infections several times a year. In the rainy season (June to July in Japan), the conidia are actively disseminated. In the hot summer, however, the fungus is usually inactive. In autumn, it becomes active again and new infection of buds occurs. The infection tends to last until the middle or late autumn in Japan.

For more information on the biology or physiology of the pathogen, see Yamamoto & Tanaka (1962; 1963), Tanaka & Yamamoto (1964), Misonou & Fukatsu (1970; 1971), Takanashi *et al.* (1970), Umemoto & Nagai (1985), Umemoto (1990, 1991a, 1991b), Eguchi & Yamagishi (2008), Asari (2016), and Ishii *et al.* (in press).

## DETECTION AND IDENTIFICATION

### Symptoms

In early spring, bud scales infected the previous year develop and form conidia, which infect the basal portion of young clusters and produce black sporulating lesions. Subsequently, abundantly sporulating lesions can be observed on leaves, petioles, fruit and young shoots. Infections of petioles and peduncles result in premature abscission of leaves and fruit, respectively. Uneven development or cracking of the fruit occurs after infections. The quantity of conidia formed on leaves decrease after summer has passed.

### Morphology

Conidia occur singly and are one-celled, pale-brown, ovate, but sometimes irregular in shape, 6.4-27.9 x 3.7-14.7 µm. Ascospores are unequally two-celled, with a septum near the base, pale-brown, 10.0-15.0 x 3.8-6.8 µm.

A full description is given by Tanaka & Yamamoto (1964), Ishii & Yanase (2000), Ishii *et al.* (2002), and Ishii *et al.* (in press).

### **Detection and inspection methods**

Typical symptoms of scab may be observed on fruit. Host plants for planting at the dormant stage may carry the pathogen in the form of mycelia in the inner tissues of bud scales without showing any symptoms, thus, escaping detection via visual inspection (EFSA, 2017).

Based on a nucleotide sequence of the rDNA-ITS (ribosomal DNA-internal transcribed spacer) regions, a PCR (polymerase chain reaction) test was developed to identify *V. nashicola* (Le Cam *et al.*, 2001; Zhao *et al.*, 2016). For quarantine inspection of fruit, a real-time PCR test was also developed using a nucleotide sequence of the translation elongation factor-1  $\alpha$  gene (Yun *et al.*, 2015).

## **PATHWAYS FOR MOVEMENT**

Under natural conditions, *V. nashicola* spreads by conidia or ascospores within orchards. In international trade, *V. nashicola* is liable to be carried on infected plants for planting (with or without leaves) of the host *Pyrus* as well as on fresh fruit of host plants (EFSA, 2017; USDA, 2009).

## **PEST SIGNIFICANCE**

### **Economic impact**

In Eastern Asia, *V. nashicola* is one of the most serious pathogens in *Pyrus pyrifolia* var. *cultiva*, *P. bretschneideri*, and *P. ussuriensis*. The pathogen causes fruit drop, cracking, and malformation. A very small number of scab-resistant cultivars are commercially available, and these are all within the variety *Pyrus pyrifolia* var. *cultiva* (Ishii & Kimura 2018; Ishii *et al.* in press).

### **Control**

Commercial orchards have been successfully protected by chemical spraying coupled with routine inspections, and removal of infected parts, and of pear leaves from the ground in particular, to reduce primary infection source. However, strains of *V. nashicola* resistant to benzimidazole (MBC) fungicides are widely distributed throughout Japan, making it difficult to control the disease with this group of fungicides (Ishii *et al.*, 1985; Ishii, 2012). MBC resistance has also been found in the Republic of Korea (Kwak *et al.* 2017) and China (Ishii *et al.* 2009). Since 1986, sterol demethylation inhibitors (DMIs), such as triflumizole, bitertanol, fenarimol, hexaconazole, fenbuconazole, difenoconazole and others have been introduced into Japan for the control of pear scab, and have replaced benzimidazoles for this purpose. Subsequently, the pathogen developed resistance to DMIs as well (Kikuhara & Ishii, 2008; Ishii, 2012). DMI resistance has also been reported in the Republic of Korea (Kwon *et al.* 2010).

### **Phytosanitary risk**

*V. nashicola* is undoubtedly of considerable economic importance on Asian pears, but its significance for the EPPO region is questionable now that it has been demonstrated that *P. communis* is not a host of *V. nashicola*. EFSA (2017) notes that the impact at the EU level is expected to be limited because Asian pears are not major crops in the EU but that the impacts of the pathogen to individual growers and enterprises could be significant. If the pathogen was introduced in the EPPO region, it could establish on Asian pears as the climate is likely to be suitable.

## **PHYTOSANITARY MEASURES**

Phytosanitary measures, in particular for host plants for planting, may be justified in countries where Asian pears are

important crops. Biosecurity New Zealand (2009) estimated that the likelihood of introduction of *V. nashicola* with fruit is low as the fungus could only spread from an infected fruit to an orchard if infected fruit is disposed underneath or in the immediate vicinity of a nashi tree or orchard.

EFSA (2017) suggest the following mitigation methods to prevent the introduction of *V. nashicola* into the EU: host plants for planting (including plants at dormant stage) and fresh fruit should be imported from pest-free areas or pest-free places of production and inspected both at the place of origin and at the EU entry point. Biosecurity New Zealand (2009) and USDA (2009) recommend that fruit comes from a pest-free area or a pest-free place of productions, or that fruit lots are inspected for symptoms before export.

## REFERENCES

Asari M (2016) *Venturia inaequalis*, causal agent of apple scab, has lower tolerance than *V. nashicola*, causal agent of Japanese pear scab, for high temperature. *Japanese Journal of Phytopathology* **82**, 185-191.

Biosecurity New Zealand (2009) Import Risk Analysis: Pears (*Pyrus bretschneideri*, *Pyrus pyrifolia*, and *Pyrus* sp. nr. *communis*) fresh fruit from China. 462 pp. <https://www.mpi.govt.nz/dmsdocument/2884-Pears-Pyrus-bretschneideri-Pyrus-pyrifolia-and-Pyrus-sp.-nr.-communis-fresh-fruit-from-China-Final-Risk-Analysis-October-2009>

Cho EK, Cho WT, Lee EJ (1985) The causal organism of pear scab in Korea. *Korean Journal of Mycology* **13**, 263-265.

EFSA (2017), EFSA Panel on Plant Health, Jeger M, Bragard C, Caffier D, Candresse T, Chatzivassiliou E, Dehnen-Schmutz K, Gilioli G, Gregoire J-C, Jaques Miret JA, MacLeod A, Navajas Navarro Maria, Niere B, Parnell S, Potting R, Rafoss T, Urek G, Van Bruggen A, Van der Werf W, West J, Winter S, Gonzalez-Dominguez E, Vicent A, Vloutoglou I, Bottex B and Rossi V, Scientific Opinion on pest categorisation of *Venturia nashicola*. *EFSA Journal* **15**(11), 5034, 22 pp. <https://doi.org/10.2903/j.efsa.2017.5034>

Eguchi N, Yamagishi N (2008) Ascospores of the Japanese pear scab fungus (*Venturia nashicola* Tanaka & Yamamoto) are discharged during the day. *Journal of General Plant Pathology* **74**, 41-45.

Ishii H (2012) Resistance in *Venturia nashicola* to benzimidazoles and sterol demethylation inhibitors. In: Thind TS (ed) *Fungicide Resistance in Crop Protection*. CABI, Wallingford (GB), pp21-31.

Ishii H, Kimura Y (2018) A new interspecific pear cultivar Yutaka: highly resistant to the two major diseases scab and black spot on Asian pears. *European Journal of Plant Pathology* **152**, 507-514.

Ishii H, Nishimura K, Tanabe K, Yamaoka Y (in press). Pathogenic specialization of *Venturia nashicola*, causal agent of Asian pear scab, and resistance of pear cultivars Kinchaku and Xiangli. *Phytopathology*, <https://doi.org/10.1094/PHTO-06-20-0220-R>

Ishii H, Udagawa H, Yanase H, Yamaguchi A (1985) Resistance of *Venturia nashicola* to thiophanate-methyl and benomyl: build-up and decline of resistance in the field. *Plant Pathology* **34**, 363-368.

Ishii H, Watanabe H, Tanabe K (2002) *Venturia nashicola*: pathological specialization on pears and control trial with resistance inducers. *Acta Horticulturae* **587**, 613-621.

Ishii H, Yanase H (2000) *Venturia nashicola*, the scab fungus of Japanese and Chinese pears: a species distinct from *V. pirina*. *Mycological Research* **104**, 755-759. <https://doi.org/10.1017/S0953756299001720>

Johnson S, Jones D, Thrimawithana AH, Deng CH, Bowen JK, Mesarich CH, Ishii H, Won K, Bus VGM, Plummer KM (2019) Whole genome sequence resource of the Asian pear scab pathogen, *Venturia nashicola*. *Molecular Plant-Microbe Interactions* **32**, 1463-1467. <https://doi.org/10.1094/MPMI-03-19-0067-A>

Kikuhara K, Ishii H (2008) Fenarimol resistance in *Venturia nashicola*, the scab fungus of Japanese pear in Fukuoka Prefecture. *Kyushu Plant Protection Research* **54**, 24-29.

- Kwak Y, Min J, Song J, Kim M, Lee H, Kim HT (2017) Relationship of resistance to benzimidazole fungicides with mutation of  $\beta$ -tubulin gene in *Venturia nashicola*. *Research in Plant Disease* **23**, 150-158.
- Kwon SM, Yeo MI, Choi SH, Kim GW, Jun KJ, Uhm JY (2010) Reduced sensitivities of the pear scab fungus (*Venturia nashicola*) collected in Ulsan and Naju to five ergosterol-biosynthesis-inhibiting fungicides. *Research in Plant Disease* **16**, 48-58.
- Le Cam B, Devaux M, Parisi L (2001) Specific polymerase chain reaction identification of *Venturia nashicola* using internally transcribed spacer region in the ribosomal DNA. *Phytopathology* **91**, 900-904.
- Misonou T, Fukatsu R (1970) Studies on the infection and control of pear scab. II. Dispersion of conidia and their role as the origin of infection. *Bulletin of the Chiba-ken Agricultural Experiment Station* **10**, 91-98.
- Misonou T, Fukatsu R (1971) Studies on the infection and control of pear scab. III. The lesion types and sporulation of conidia on scales. *Bulletin of the Chiba-ken Agricultural Experiment Station* **11**, 96-102.
- Prokhorchik M, Won K, Lee Y, Segonzac C, Sohn KH (2020) Whole genome enabled phylogenetic and secretome analyses of two *Venturia nashicola* isolates. *Plant Pathology Journal* **36**, 98-105.
- Sivanesan A (1977) *The taxonomy and pathology of Venturia species*, pp. 94-99. J. Cramer, Vaduz, Liechtenstein.
- Takanashi K, Yamamoto S, Kitajima H (1970) Primary inoculum of Japanese pear scab. *Bulletin of the Horticultural Research Station, Japan* A-9, 17-33.
- Tanaka S, Yamamoto S (1964) Studies on pear scab. II. Taxonomy of the causal fungus of Japanese pear scab. *Annals of the Phytopathological Society of Japan* **29**, 128-136.
- USDA (2009) Importation of fresh fruit of Chinese sand pear, *Pyrus pyrifolia*, from China, including the special administrative regions of Hong Kong and Macau, into the entire United States, including all territories - a qualitative, pathway-initiated risk assessment. 76 pp. APHIS-2011-0007-0002. Available from <https://beta.regulations.gov/document/APHIS-2011-0007-0002>
- Umemoto S (1990) Infection sources in Japanese pear scab (*Venturia nashicola*) and their significance in the primary infection. *Annals of the Phytopathological Society of Japan* **56**, 658-664.
- Umemoto S (1991a) Infection of bud scales with conidia of Japanese pear scab fungus, *Venturia nashicola*. *Annals of the Phytopathological Society of Japan* **57**, 188-195.
- Umemoto S (1991b) Relationship between leaf wetness period, temperature, and infection of *Venturia nashicola* to Japanese pear leaves. *Annals of the Phytopathological Society of Japan* **57**, 212-218.
- Umemoto S (1993) Studies on the ecology and control of Japanese pear scab. *Special Bulletin of the Chiba- Ken Agricultural Experiment Station* **22**, 1-99.
- Umemoto S, Nagai Y (1985) The infection period of flower bud scales by Japanese pear scab fungus and effective fungicidal control method for scab during middle to late autumn. *Bulletin of the Chiba-ken Agricultural Experiment Station* **26**, 129-135.
- Yamamoto S, Tanaka S (1962) Studies on the pear scab (*Venturia* spp.). I. Cultural characteristics of the causal fungus with special reference to sporulation. *Bulletin of the Horticultural Research Station, Japan* B-1, 163-171.
- Yamamoto S, Tanaka S (1963) Studies on the pear scab (*Venturia* spp.). III. Infection on the leaves by conidia. *Bulletin of the Horticultural Research Station, Japan* B-2, 181-192.
- Yun YH, Yoon SK, Jung JS, Kim SH (2015) Specific and sensitive detection of the pear scab fungus *Venturia nashicola* by SYBR green real-time PCR. *Journal of Microbiology and Biotechnology* **25**, 1782-1786. <https://doi.org/10.4014/jmb.1507.07095>

Zhao P, Kakishima M, Uzuhashi S, Ishii H (2012) Multigene phylogenetic analysis of inter- and intraspecific relationships in *Venturia nashicola* and *V. pirina*. *European Journal of Plant Pathology* **132**, 245-258.

Zhao P, Yamada A, Kakishima M, Ishii H (2016) In planta expression profiles and sequence variation of the endopolygalacturonase gene in *Venturia nashicola*, the causal agent of Asian pear scab. *Tropical Plant Pathology* **41**, 67-77. <https://doi.org/10.1007/s40858-016-0069-5>

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## How to cite this datasheet?

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## Datasheet history

This datasheet was first published in two editions of 'Quarantine Pests for Europe' in 1992 and 1997, and revised in 2020. It is now 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.

CABI/EPPO (1992/1997) *Quarantine Pests for Europe (1<sup>st</sup> and 2<sup>nd</sup> edition)*. CABI, Wallingford (GB).



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