



The Food & Environment Research Agency

Rapid Pest Risk Analysis for

Gymnosporangium asiaticum

This document provides a rapid assessment of the risks posed by the pest to the UK in order to assist Risk Managers decide on a response to a new or revised pest threat. It does not constitute a detailed Pest Risk Analysis (PRA) but includes advice on whether it would be helpful to develop such a PRA and, if so, whether the PRA area should be the UK or the EU and whether to use the UK or the EPPO PRA scheme.

STAGE 1: INITIATION

1. What is the name of the pest?

Gymnosporangium asiaticum (Miyabe ex Yamada) Syn: *G. chinense*(Long), *G. haraeaeum* (H. Sydow & Sydow), *G. japonicum*, *G. koreaense* (Jackson), *G. spiniferum* (H. Sydow & Sydow), *Rosestelia koreaensis*. (P. Hennings)

Common names: leaf rust of Japanese pear; leaf rust of juniper.

2. What is the pest's status in the EC Plant Health Directive (Council Directive 2000/29/EC¹) and in the lists of EPPO²?

This pathogen is covered in the EU legislation by the listing in Annex IAI of *Gymnosporangium spp.* (non-European) in Council Directive 2000/29/EC. *G. asiaticum* is included as in the EPPO A2 list.

3. What is the reason for the rapid assessment?

An assessment is required to help inform the decision on whether current legislation adequately mitigates the risks to the UK associated with this pathogen.

STAGE 2: RISK ASSESSMENT

4. What is the pest's present geographical distribution?

(EPPO PQR data) Asia: China (Hong Kong); Japan; Democratic People's Republic of Korea (North Korea); Republic of Korea (South Korea); Russian Far East; Taiwan. North America: USA.

5. Is the pest established or transient, or suspected to be established/transient in the UK?

G. asiaticum is absent from the UK. There were five interceptions at two UK nurseries in 2008 on Junipers brought in from Japan under the derogation for the import of naturally and artificially dwarfed plants. These plants all originated from the same nursery in Japan and these interceptions resulted in the destruction of all plants which had been imported into the

¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0029:20100113:EN:PDF>

² [http://archives.eppo.int/EPPOStandards/PM1_GENERAL/pm1-02\(21\)_A1A2_2012.pdf](http://archives.eppo.int/EPPOStandards/PM1_GENERAL/pm1-02(21)_A1A2_2012.pdf)

UK from that nursery. *G. asiaticum* has been intercepted in the UK in 1974 and 1982 on dwarf bonsai juniper (*J. chinensis*) trees from Japan. There has also been an interception in France in 1988 and again on *J. chinensis* bonsai plants (EPPO RS 1974 & 1988).

6. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK?

G. asiaticum, like other *Gymnosporangium* spp., is heteroecious and requires a *Juniperus* spp. and a rosaceous host of subfamily Pomoideae to complete its life cycle. During the winter the fungus survives as mycelium on juniper and in spring, telia with teliospores are formed. The basidiospores released by the germinated teliospores must then infect a rosaceous species to complete the life cycle.

The following hosts are listed in the *Gymnosporangium asiaticum* datasheet (Available online via EPPO). Aecial hosts: *Pyrus pyrifolia* (Japanese pear), other Asian pears, *P. communis* (European pear), *Cydonia oblonga* (quince), *Chaenomeles*, *Crataegus* spp. (hawthorn) and *Photinia*. Telial hosts: *Juniperus chinensis*, *J. procumbens* (cedar), *J. horizontalis*, *J. media*, *J. sabina*, *J. scopulorum*, *J. squamata*, *J. virginiana*.

The following host species are listed by EPPO PQR: Major hosts: *Pyrus pyrifolia*, *P. pyrifolia* var. *culta*. Alternate hosts are listed as *Juniperus*, *J. chinensis*, *J. rigida*.

Incidental hosts are listed as *Chaenomeles*, *C. japonica*, *C. speciosa*, *Crataegus*, *Cydonia oblonga*, *Malus toringo*, *Photinia*, *P. villosa*, *Pseudocydonia sinensis* (*Chaenomeles sinensis*). *Pyrus*, *P. communis*, *P. fauriei* and *P. ussuriensis*.

The most important hosts to the UK are cultivated pear (*P. communis*) and *J. chinensis* grown as a garden ornamental and specimen tree. Environmental hosts which could be affected are *J. communis* (common juniper) and hawthorn (*Crataegus monogyna*), that could be infected by *G. asiaticum* f. sp. *cretaegicola* (Li 1992).

7. If the pest needs a vector, is it present in the UK?

G. asiaticum does not need a vector to facilitate its spread.

8. What are the pathways on which the pest is likely to move and how likely is the pest to enter the UK? (By pathway):

Four pathways have been assessed:.....

8.1 Plants for planting of Juniper

Very unlikely ☒ Unlikely ☐ Moderately likely ☐ Likely ☐ Very likely ☐

***Juniperus* sp.**

The movement of plants for planting of *Juniperus* sp. from non-European countries into the EU is prohibited (Council directive 2000/29/EC Annex IIIA point 1). As the pest is recorded as absent from European countries this prohibition will effectively mitigate the risk associated with plants of *Juniperus* sp. It is noted that the pest is present in Russia but its distribution is limited to the far eastern areas, meaning that, although *Juniperus* sp. can enter the EU from European Russia, this potential trade should not pose a significant entry risk to the UK.

However despite the general prohibition of *Juniperus sp.* from non-European countries there are derogations which allows for bonsais from Japan (2002/887/EC) and the Republic of Korea (2002/499/EC) to be imported into the EU. These derogations allow for the import of bonsai of *Juniperus sp.* under specific conditions. These require that imported *Juniperus sp.* need to have been grown for two years prior to export to the EU on a registered nursery, which has been subject to an officially supervised control regime. The junipers and the alternate rosaceous hosts which have been grown on the place of production and its immediate vicinity have been inspected at least six times a year for the presence of *G. asiaticum*. On arrival in the EU plants must be placed in post entry quarantine for a period which covers at least the 1st April until the 31st June and, before release, must be inspected and found free from *G. asiaticum*. As mentioned earlier this pathogen has been identified in plants in post entry quarantine and the infected plants and all others from the originating nursery in Japan were destroyed. The effectiveness of the current regulations minimise *G. asiaticum* entry risks from plants for planting of *Juniperus*.

8.2 Plants for planting of rosaceous hosts

Plant for planting of Rosaceous hosts:	Very unlikely	<input checked="" type="checkbox"/>	Unlikely	<input type="checkbox"/>	Moderately likely	<input type="checkbox"/>	Likely	<input type="checkbox"/>	Very likely	<input type="checkbox"/>
--	---------------	-------------------------------------	----------	--------------------------	-------------------	--------------------------	--------	--------------------------	-------------	--------------------------

The movement of plants for planting of *Pyrus sp.* and *Cydonia sp.* are prohibited from non-European countries, with the exception of Mediterranean countries, Australia, New Zealand, Canada and the continental states of the USA (Directive 2000/20/EC Annex III point 18). Additionally plants for planting *Pyrus sp.* *Cydonia sp.* *Chaenomeles sp.* and *Crataegus sp.* are prohibited from all Non-European countries other than in a dormant state (Directive 2000/20/EC Annex III point 9). Further regulations prohibit plants for planting of *Photinia sp.* (other than in a dormant state) from USA, China, Japan, Republic of Korea and Democratic Republic of Korea (Directive 2000/20/EC Annex III point 9.1). Infection of the rosaceous hosts does not persist after infected leaves have fallen. Therefore dormant plants of the rosaceous hosts do not pose a significant entry risk for *G. asiaticum*.

8.3 Plant Parts – cut branches

Juniperus sp.

Cut branches of Juniper:	Very unlikely	<input checked="" type="checkbox"/>	Unlikely	<input type="checkbox"/>	Moderately likely	<input type="checkbox"/>	Likely	<input type="checkbox"/>	Very likely	<input type="checkbox"/>
--------------------------	---------------	-------------------------------------	----------	--------------------------	-------------------	--------------------------	--------	--------------------------	-------------	--------------------------

It was recommended by EPPO that in addition to plant for planting of Juniper cut braches were also prohibited and as the current prohibition refers to plant (which included all plants parts), not just plants intended planting, the risk associated with this potential pathway are adequately mitigated.

8.4 Rosaceous hosts

Cut branches of rosaceous hosts:	Very unlikely	<input checked="" type="checkbox"/>	Unlikely	<input type="checkbox"/>	Moderately likely	<input type="checkbox"/>	Likely	<input type="checkbox"/>	Very likely	<input type="checkbox"/>
----------------------------------	---------------	-------------------------------------	----------	--------------------------	-------------------	--------------------------	--------	--------------------------	-------------	--------------------------

Unlike the prohibition for junipers, legislation covering the rosaceous hosts refers only to plants of planting. However, there is a small entry risk associated with cut branches with leaves attached especially, if infected material was disposed of close to *Juniperus* hosts. (See comments regarding consideration of additional regulation to close this pathway in section 15).

9. How likely is the pest to establish outdoors or under protection in the UK?

Outdoors:	Very unlikely	<input type="checkbox"/>	Unlikely	<input type="checkbox"/>	Moderately likely	<input checked="" type="checkbox"/>	Likely	<input type="checkbox"/>	Very likely	<input type="checkbox"/>
Under protection:	Very unlikely	<input type="checkbox"/>	Unlikely	<input type="checkbox"/>	Moderately likely	<input type="checkbox"/>	Likely	<input checked="" type="checkbox"/>	Very likely	<input type="checkbox"/>

G. asiaticum could very probably establish in the UK as *J. chinensis* is present as a garden ornamental that would serve as the telial host. However the major host, *P. pyrifolia*, is a very minor crop in Europe (EPPO/CABI, 1996; EPPO Data sheets on Quarantine pests).

European pear, though recorded as a minor host, does not appear to suffer significant damage from infection and would probably be a poor host for the pathogen. Germination of the teliospores can take place and produce basidiospores at temperatures ranging from 5 to 28°C with an optimum between 16 and 20°C (Dong *et al.* 2006). These temperatures are similar to those at which the spores of *G. sabinae* (European pear-juniper rust) germinate (5-20°C), which is established in the UK.

G. asiaticum has been identified in the UK in plants under protection as bonsais imported from Japan, which were being grown in post entry quarantine under Commission Decision 2002/887/EC (Affected plants were destroyed without risk of further spread).

10. How quickly could the pest spread in the UK?

Natural spread:	Very slowly	<input type="checkbox"/>	Slowly	<input checked="" type="checkbox"/>	Moderate pace	<input type="checkbox"/>	Quickly	<input type="checkbox"/>	Very quickly	<input type="checkbox"/>
In trade:	Very slowly	<input type="checkbox"/>	Slowly	<input type="checkbox"/>	Moderate pace	<input type="checkbox"/>	Quickly	<input checked="" type="checkbox"/>	Very quickly	<input type="checkbox"/>

G. asiaticum is spread by airborne spores (aeciospores and the less robust basidiospores). *Pyrus pyrifolia* trees within 100 m of an infected *J. chinensis* tree are at high risk of infection, and up to 1000 m in windy situations (Unemoto *et al.* 1989). The requirement for proximity of telial and aecial hosts would reduce spread of the pathogen because *J. chinensis* has a restricted distribution in the UK, where it is planted as a garden ornamental. The pathogen would spread quickly if nursery stock became infected and were sold on.

11. What is the area endangered by the pest?

Any area where the hosts are prevalent would be considered to be endangered.

12. What is the pest's economic, environmental or social impact within its existing distribution?

Very small	<input type="checkbox"/>	Small	<input type="checkbox"/>	Medium	<input checked="" type="checkbox"/>	Large	<input type="checkbox"/>	Very large	<input type="checkbox"/>
------------	--------------------------	-------	--------------------------	--------	-------------------------------------	-------	--------------------------	------------	--------------------------

This rust is considered to be a serious pathogen of *P. pyrifolia* in the Far East including Japan, but it has not been possible to quantify the economic impact. It is also, in its telial stage, one of the most important and widely distributed fungal pests of urban ornamentals (*Juniperus chinensis*) in China (Zhang 1990; Xu and Zhu 1997). Though *G. asiaticum* has been found in North America, there is no indication that it has any practical importance there, or that it causes significant disease of any rosaceous host other than *P. pyrifolia* (CABI Crop Protection Compendium).

13. What is the pest's potential to cause economic, environmental or social impacts in the UK?

Very
small

☐

Small

☒

Medium

☐

Large

☐

Very
large

☐

G. asiaticum probably could establish in the UK where *J. chinensis* has been introduced. However, the impact of the disease depends on the proximity and population size of the alternate hosts. The restricted occurrence of *J. chinensis* as a garden ornamental will limit impacts of the disease. In North America there have been no reports of significant disease caused by *G. asiaticum* aside from *Pyrus pyrifolia* cultivars. Host range experiments with *G. asiaticum* found that *P. communis* was resistant and that only tiny limited lesions were produced following injection of the pathogen (Sakuma 1992). The lack of aggressive symptoms in *P. communis* will very likely translate to low spore yield, which would reduce the probability of the pathogen finding its alternate host to complete its life cycle. *G. asiaticum* has been controlled in pear by antifungal treatment (Lee, 1990; Ohyama *et al.* 1988), which provides a means of controlling the disease in orchards.

There have been no reports of damage to *J. communis* as a consequence of *G. asiaticum* infection and potential impacts in this species are scored as small. However, there is some uncertainty as there is a lack of experimental evidence to rule out the prospect that *G. asiaticum* could damage this host. Hawthorn infections by *G. asiaticum* f. sp. *crataegicola* are a concern, though there is little evidence of the extent and damage caused by the pathogen in China, where the disease has been reported (Wang *et al.* 1993). In any case the absence or very low populations of Juniper species in the UK countryside, which could serve as alternate hosts, would limit damage to hawthorn to only small impacts.

14. What is the pest's potential as a vector of plant pathogens?

G. asiaticum will not vector plant pathogens.

STAGE 3: PEST RISK MANAGEMENT

15. What are the risk management options for the UK? (*Consider exclusion, eradication, containment, and non-statutory controls; under protection and/or outdoors*).

The risk associated with *G. asiaticum* is largely mitigated by the current legislation. The only minor weakness in the current requirements is that cut branches of rosaceous hosts with leaves attached are not regulated. However the risk associated with these is low and it would seem unlikely that regulation would significantly reduce the risk of *G. asiaticum* entering the UK.

EC IAI, Commission Decisions 2002/887/EC and 2002/449/EC, EPPO A2

16. Summary and conclusion of rapid assessment.

(*Highlight key uncertainties and topics that will require particular emphasis in a detailed PRA*) General / overall summary and conclusion and then specific text on each part of assessment...

This rapid assessment shows:

Risk of entry: Current legislation adequately mitigates the entry risks associated with *G. asiaticum* and all pathways were scored as very unlikely.

Risk of establishment: The risk of establishment is scored as moderately likely outdoors and likely under protection.

Economic impact: Where *G. asiaticum* has been introduced in the USA the economic impact has been low due to minimal effects of native rosaceous (apart from *P. pyrifolia*). The restricted population of *J. chinensis*, which is planted as a garden ornamental in the UK, also limits the potential UK economic impacts from the pathogen, which are scored as low.

Endangered area: It is likely that *G. asiaticum* would be able to establish in the UK wherever *J. chinensis* is grown as a garden ornamental.



Risk management: Current legislation is adequate to prevent entry of *G. asiaticum*. When the pathogen has entered the UK in imported bonsai trees, post entry quarantine requirements and official inspections identified the infection and destroyed the plants before they were released.

17. Is there a need for a detailed PRA? If yes, select the PRA area (UK or EU) and the PRA scheme (UK or EPPO) to be used. (*for PH Risk Management Work stream to decide*)

No	X
----	---

		PRA area: UK or EU		PRA scheme: UK or EPPO	
--	--	-----------------------	--	---------------------------	--

18. IMAGES OF PEST

<p>Photo 1 Japanese pear rust (<i>Gymnosporangium asiaticum</i>)</p>  <p>UGA1949019</p>	<p>Photo 2 Japanese pear rust (<i>Gymnosporangium asiaticum</i>)</p>  <p>5426944</p>
<p>Harpenden/Fera (British Crown). IPM images Bugwood.</p>	<p>Photo by Yuan-Min Shen. IPM images Bugwood.</p>

19. Given the information assembled within the time scale required, is statutory action considered appropriate / justified?

Yes

Statutory action

☒

No

Statutory action

☐

Continued statutory action is necessary to mitigate the risks to the UK from *G. asiaticum*. Though existing regulation very largely mitigates risks from this rust additional regulation for cut branches of the rosaceous host could be considered but it seems unlikely that further regulation would significantly reduce the risk.

References

CABI Crop Protection Compendium online. <http://www.cabi.org/cpc>

Dong, X.-L., Li, B.-H., Zhang, Z.-F., Li, B.-D., and Xu, X.-M. (2006) Effect of environmental conditions on germination and survival of teliospores and basidiospores of the pear rust fungus (*Gymnosporangium asiaticum*). *European Journal of Plant Pathology*, 115:341–350

EPPO, 2006. *Gymnosporangium* spp. (non-European). *Bulletin OEPP/EPPO Bulletin*, 36(3):441-446. Available at <http://www.blackwell-synergy.com/servlet/useragent?func=showIssues&code=epp>

EPPO/CABI (1996) *Gymnosporangium yamadae*. In: *Quarantine pests for Europe*. 2nd edition (Ed. by Smith, I.M.; McNamara, D.G.; Scott, P.R.; Holderness, M.). CAB International, Wallingford, UK.

EPPO, 2013. PQR database. Paris, France: European and Mediterranean Plant Protection Organization. Available at <http://www.eppo.org>

Lee, D.H. (1990) Protective and curative effects of ergosterol biosynthesis inhibitors against pear rust. *Korean Journal of Plant Pathology* 6, 343-351.

Li, DZ. (1992) Study on the regularity of *Gymnosporangium asiaticum* Miyabe ex Yamada f.sp. *crataegicola* and its control on hawthorn trees. China Fruits: 14-17

Ohyama, H.; Wada, T.; Ishikawa, H.; Chiba, K. (1988) HF-6305, a new triazole fungicide. In: Brighton Crop Protection Conference. Pests and Diseases - 1988, pp. 519-526. British Crop Protection Council, Thornton Heath, UK.

Sakuma T. (1992) Pathogenic races of *Gymnosporangium-asiaticum* on Japanese pear and pathogenicity to some species in genus *Pyrus*. Bulletin of the Fruit Tree Research Station: 67-78

Unemoto, S.; Murata, A.; Nagai, Y. (1989) Dispersal of Japanese pear rust fungus, *Gymnosporangium asiaticum*. Annals of the Phytopathological Society of Japan 55, 250-253.

Wang, K., Bai, J.K. Li, D.H. Deng, G.Y. (1993) Identification and biological characteristics of *Gymnosporangium asiaticum* f.sp. *crataegicola* infecting hawthorn. Acta Phytopathologica Sinica 23, 187-192.

Xu H, Zhu Y (1997) Study on the occurrence of *Gymnosporangium asiaticum* in Hangzhou district and its control. China Fruits: 10-12.
(Available at: <http://nt.ars-grin.gov/fungaldatabases>)

Zhang NT, 1990. Report of a national survey on diseases of urban ornamental plants. Forest Pest and Disease, 1:44-46

Date of production: feb 2014

Version no.: 1

Author (s): Sharon Matthews-Berry

Note

It should be noted that although the current legislation adequately mitigates against the risk of entry of *G. asiaticum* there are other non European *Gymnosporangium spp.* whose hosts may not all be covered by the current legislation. It has been suggested that *G. asiaticum* appears to present a much lesser risk than *G. juniperi-virginianae* or *G. yamadae* (EPPO/CABI, 1996). The hosts of both these species are junipers and *Malus sp.* with *G. juniperi-virginianae* being present only in N. America and *G. yamadae* being present in N. America, China, Japan and Korea. However, given the distribution and the hosts of these two species, the current legislation would mitigate the risk associated with both these species. There are however many *Gymnosporangium spp.* which would be covered by the listing in Annex IAI of directive 2000/29, and although a full assessment of the distribution and host range has not been made there may be some gaps in the current legislation which could allow entry of certain *Gymnosporangium spp.* For example, for *Gymnosporangium globosum*, which is present in N. America, *Sorbus spp.* and *Amelanchier spp.* are record as hosts. There are no specific requirements relating to these hosts which would mean that they could be entering the EU with leaves and therefore could pose a risk.