

## Vietnam Pest Risk Assessment Information

Based on inputs received from ASTA member companies regarding seed exports to Vietnam, USDA APHIS conducted an analysis of pests of potential concern that were associated with 15 different genera of seed. A total of 508 pests were identified of which 46 were determined to be of potential quarantine significance to Vietnam. APHIS is conducting pest risk assessments on these 46 pests of potential quarantine significance; however, APHIS has requested additional information from the seed industry in order to complete the PRA process. Listed below is the additional information provided by ASTA and its members arranged by crop species and associated pathogens.

Of the 46 pests, only two are currently of regulatory concern to Vietnam: *Clavibacter michiganensis michiganensis* and *Pantoea stewartii*. Based on feedback from ASTA members, the remaining 44 are minor pests that are rarely if ever seen in seed production areas in the U.S. Although they may be listed as potential pests associated with seed, they are more commonly associated with food/feed production, as seed is primarily produced in drier areas in the western or southwestern U.S. where conditions generally are not favorable for manifestation of plant or seed pathogens. In addition, many quality management practices used in seed production such as field inspections of mother plants, intensified pest management practices, and seed cleaning/sorting/separation techniques employed both at harvest and post harvest further reduce risk of these pests being associated with seed.

### ***Zea mays***

APHIS has identified 11 organisms of potential quarantine significance for *Zea mays* seed. With the exception of Stewart's wilt, all these pests are considered inconsequential and are rarely, if ever encountered in seed production of *Z. mays*. Of these eleven organisms, phytosanitary certification to meet import requirements of other countries are required for seven of them (identified by asterisk).

- *Clavibacter michiganensis subsp nebraskensis*\*
- *Pantoea stewartii*\*
- *Pseudomonas corrugata*
- *Pseudomonas viridiflava*
- *Gibberella avenacea*
- *Glomerella graminicola*\*
- *Sarocladium strictum*
- *Stenocarpella macrospora*\*
- *Stenocarpella maydis*\*
- *Maize Chlorotic mottle virus*\*
- *Maize dwarf mosaic virus*\*

The remaining four organisms listed without asterisk are new to export certification for *Z. mays* seed as they are not encountered in seed production areas in the US and therefore merit reconsideration as quarantine pests of significance. The table below lists the organisms and their distribution, along with available seed treatments and seed tests. Most of his information is from the CABI CPC.

Pest	Distribution	Seed Treatment	Seed Test
<i>Pseudomonas corrugata</i>	Not reported in: HI, CA, OR, ID, IA, IL, IN, MN, NE, KS, TX, GA, MO, DE, PA	Can be controlled without any negative effect on seed germination by immersing the seeds in a solution containing cupric acetate, acetic acid, pentachloronitrobenzene	Selective media assay with pathogenicity
<i>Pseudomonas viridiflava</i>	Not reported in: HI, WA, OR, IL, IA, IN, MN, SD, KS, TX, PA, FL	No seed treatment available	Selective media assay with pathogenicity
<i>Gibberella avenacea</i>	Not reported in: HI, OR, IL, IA, IN, MN, OH, PA, MI, MO, KS, SD, TN, GA,DE	Thiram, TBZ, Prochloraz and Topsin were effectively used as seed dressers	Freeze/blotter assay as per ISTA “Common Laboratory Seed Health Testing Methods for Detecting Fungi”
<i>Sarocladium strictum</i>	Not reported in: HI, WA, OR	Benomyl, thiophanate and carbendazin have been very effective in reducing seed borne inoculum	Freeze/blotter assay as per ISTA “Common Laboratory Seed Health Testing Methods for Detecting Fungi”

**Oryzae spp.**

For *oryzae* seed APHIS has identified five organisms as pathogens of potential quarantine significance. Most of the organisms on this list do not directly affect *oryzae* production in the USA, but are present in the country. *Oryzae* seed produced in the USA is not directly affected by these pathogens (marked with asterisk) because *oryzae seed* production occurs in areas where these pathogens do not occur.

- *Pseudomonas syringae pv syringae\**
- *Balansia oryzae-sativae\**
- *Gibberella avenacea\**
- *Monographella nivalis\**

# AMERICAN SEED TRADE ASSOCIATION



- *Trichoconiella padwickii*

*T. padwickii* should not be on the list as it is known to occur in Vietnam. Our proposal is to include an AD on the PC that these pests do not occur in rice seed production areas in the US.

Pest	Distribution	Seed Treatment	Seed Test
<i>Trichoconiella padwickii</i>	Reported in: TX, AR, LA	Seed-treatment fungicides are reported to give control of seed infection. Also seed treatment with hot water or mancozeb appears to be essential to control seedborne infection in high-yielding cultivars	Blotter method per ISTA seed health test for oryzae

## ***Solanum***

Quarantine pathogens for *Solanum* are listed below. The predominant seed production for *Solanum* spp. occurs in the state of California. Some tomato seed production also occurs in Florida. Phytosanitary field inspections and/or lab testing is currently conducted for those pests that are marked with an asterisk. Export certification is not required for the remaining pests as they either do not occur in seed production areas in California or they are not considered by any other trading partners to be of quarantine significance.

- *Clavibacter michiganensis subsp. Michiganensis*\*
- *Pseudomonas corrugata*\*
- *Pseudomonas syringae pv. Tomato*\*
- *Pseudomonas syringae pv syringae*\*
- *Pseudomonas viridiflava*
- *Rhodococcus fascians*
- *Alternaria brassicicola*\*
- *Alternaria dauci*
- *Alternaria japonica*
- *Gibberella avenacea*
- *Sarocladium strictum*
- *Alfalfa mosaic virus*
- *Potato spindle tuber viroid*\*
- *Tobacco streak virus*
- *Tomato bushy stunt virus*\*
- *Tomato mosaic virus*\*

# AMERICAN SEED TRADE ASSOCIATION



The table below provides information on those pests that are not currently included in export certification on *Solanum* seed. Most of this information is from the CABI CPC.

Pest	Distribution	Seed Treatment	Seed Test	Additional Notes
<i>Pseudomonas viridiflava</i>	Not reported in: HI, WA, OR, IL, IA, IN, MN, SD, KS, TX, PA, FL	none	Selective media assay with pathogenicity	An opportunistic pathogen that can cause Bacterial Leaf Blight of Tomato when the plants are stressed. It is also associated with Stem Necrosis of tomato. The only reports of seed being a pathway are experimental and transmission was not demonstrated. <i>P. viridiflava</i> is on the tomato ISF pest list which means a Phyto AD has been received on tomato.
<i>Rhodococcus fascians</i>	Reported in: WA, OR, CA, KS, OK MO, IA, GA, MI, OH, IN, VA, MD, PA, NJ, NY, CN, MA	Hot-water treatment of <i>Tropaeolum</i> seeds (1 hour incubation in cold water, 30 minutes at 51.7°C, cool and dry) eradicates <i>R. fascians</i> cells (Baker, 1950).	A selective medium has been described by Takayama et al. (1985).	There are very few references on this bacterium on <i>S. lycopersicum</i> . There is no indication that the bacterium is associated with seed of <i>S. lycopersicum</i> . <i>R. fascians</i> is on the tomato ISF pest list so there have been Phyto AD requests for this bacterium on tomato.
<i>Alternaria dauci</i>	Reported in: CA, ID, NM, IL, WI, MI, OH, WV, NC, HI, NJ< NY, CN, MA	Seed treatment with HCl solution reduced infection by <i>A. dauci</i> , but with increasing concentration of HCl the number of dead seeds and healthy but ungerminated seedlings rose (Bralewski et al., 2004).	Blotter test (Gambogi, 1987), PCR, Agar plate test (Gambogi, 1987)	<i>S. lycopersicum</i> is not a host of <i>A. dauci</i> . This species is specific to carrots and seed is a pathway on carrots. <i>A. dauci</i> is on the tomato ISF pest list which means Phyto AD has been received needlessly on tomato.

# AMERICAN SEED TRADE ASSOCIATION



<i>Alternaria japonica</i>	Reported in: CA, NM, MS, FL, OH, MN, MI, PA, NJ, MA	Many fungicides applied as a seed dressing are effective in reducing disease caused by A. japonica	Freeze/blotter assay as per ISTA “Common Laboratory Seed health Testing methods for Detecting Fungi”	A. japonica host range is limited almost exclusively to Brassica spp. Tomato as a host is not clear. One report of an association with tomato seed, however, seed as a pathway in tomato has not been proven. A. japonica on tomato is not known as a problem. A. japonica is on the tomato ISF pest list which means Phyto Ad has been received.
<i>Gibberella avenacea</i>	Not reported in: HI, OR, IL, IA, IN, MN, OH, PA, MI, MO, KS, SD, TN, GA, DE	Thiram, TBZ, Prochloraz and Topsin were effectively used as seed dressers	Freeze/blotter assay as per ISTA “Common Laboratory Seed health Testing methods for Detecting Fungi”	S. lycopersicum is not known to be host of G. avenacea. The fungus is a ubiquitous soilborne pathogen. This fungus is most common on wheat, alfalfa and a few other vegetables. It can be seedborne on grains and clover. It is on the tomato ISF pest list which means Phyto AD has been needlessly received on tomato.
<i>Sarocladium strictum</i>	Not reported in: HI, WA, OR	Benomyl, thiophanate and carbendazin have been very effective in reducing seed borne inoculum	Freeze/blotter assay as per ISTA “Common Laboratory Seed health Testing methods for Detecting Fungi”	S. lycopersicum is not known to be a host of S. strictum. This fungus is not on the tomato ISF pest list
<i>Alfalfa mosaic virus</i>	Not reported in: HI, CO, KS, ME, AZ, SD	none	ELISA Bailiss and Offei 1990, reverse transcription/PCR Bariana et al 1994, or dot blot hybridization Pestic and Hiruki,	Seed is a known pathway for AMV in S. lycopersicum.

# AMERICAN SEED TRADE ASSOCIATION



			1988.	
<i>Tobacco streak virus</i>	Reported in: WA, OR, CA, CO, KS, OK, IA, MN, WI, FL, KY, OH, NC, MD, PA	Treating dry seeds with trisodium phosphate prior to sowing reduces the risk of TMV infection (Pascual and Pérez Alfocea, 2011).	Seedborne TMV can be detected by inoculating a suspension of ground seeds on indicator hosts. ELISA tests have been used to detect tobamoviruses in tomato	<i>S. lycopersicum</i> can be a host of TSV and there is some evidence that seed can be a pathway for TSV in tomato. TSV is on the tomato ISF pest list so Phyto AD has been received.

## ***Capsicum***

For the *capsicum* family APHIS has identified only two organisms of potential quarantine significance. Only one organism, *P. syringae/syringae*, is recognized by industry or CDFA for seed export certification.

- *Pseudomonas syringae pv syringae\**
- *Pseudomonas viridiflora*

Information on *P. viridiflora* is in the table below. Information is from the CABICPC.

Pest	Distribution	Seed Treatment	Seed Test	Additional Notes
<i>Pseudomonas viridiflava</i>	Not reported in: HI, WA, OR, IL, IA, IN, MN, SD, KS, TX, PA, FL	none	Selective media assay with pathogenicity	This bacterium has been reported to cause a leaf blight in peppers but there are no reports found of seed being a pathway in pepper.

## ***Paspalum***

APHIS has identified only one organism of quarantine significance for *Paspalum*, *Balansia oryzae sativae*; however, this organism does not occur in seed production areas.

## ***Cucurbita***

- *Acidovorax citrulli* (BFB)
- *Pseudomonas syringae pv. syringae*
- *Pseudomonas viridiflora*
- *Gibberella avenacea*
- *Arabis mosaic virus*
- *Bean yellow mosaic virus*

# AMERICAN SEED TRADE ASSOCIATION



- *Squash mosaic virus*

Pest	Distribution	Seed Treatment	Seed Test	Additional Notes
<i>Acidovorax citrulli</i>	Reported in: OR CA, OK, TX, IA, MO, AR, MS, AL, GA, FL, SC, NC, IL, IN	Nomura and Shirakawa (2001) showed that hot-water treatment of infested seeds at 54-56°C for 10-30 minutes reduced disease incidence but did not eradicate the pathogen	A detailed step-by-step description of the Seminis Inc. PCR-Wash procedure, standardized by the USA National Seed Health System (NSHS) can be accessed at the website <a href="http://www.seedhealth.org">www.seedhealth.org</a> .	Seed is a pathway for <i>A. citrulli</i> in Cucurbita spp.
<i>Pseudomonas syringae pv syringae</i>	in: ID, CA, CO, GA, SC, WI, NY, NJ, AK	None	Selective media assay with pathogenicity	Pss is ubiquitous worldwide in soil, water and as an epiphyte. . No references found indicating seed is a pathway in Cucurbita spp. Pss was recently listed on the ISF pest list for squash which means a Phyto AD received.
<i>Pseudomonas viridiflora</i>	Not reported in: HI, WA, OR, IL, IA, IN ,MN, SD, KS, TX, PA, FL	None	Selective media assay with pathogenicity	No reports found indicating this is a disease problem on squash. <i>P. viridiflava</i> is not on the squash ISF pest list which means no Phyto AD has been received.
<i>Gibberella avenacea</i>	Not reported in: HI, OR, IL, IA, IN, MN, OH, PA, MI, MO, KS, SD, TN, GA,DE	Thiram, TBZ, Prochloraz and Topsin were effectively used as seed dressers	Freeze/blotter assay as per ISTA “Common Laboratory Seed health Testing methods for Detecting Fungi”	The fungus is a ubiquitous soilborne pathogen. Cucurbita spp. fruit are susceptible to infection by the Fusarium state of <i>G. avenacea</i> . Some references make general statements that it may be seedborne but no references were found proving that seed is a pathway in Cucurbita spp. It can be seedborne on grains and clover. It is on the squash ISF pest list.
<i>Arabis mosaic virus</i>	Reported in: NE, MO, MI, OH, FL, CN	None	None	The information related to ArMV in vegetables is dated (1960s) and is based on limited experimental evidence. Current sources of information do not

# AMERICAN SEED TRADE ASSOCIATION



				note the ArMV on vegetables. Listed on the squash ISF pest list which means Phyto AD received on Cucurbita spp.
<i>Bean yellow mosaic virus</i>	Reported in: WA, CA, KT, MN, TN, AL, AK	None	None	Cucurbita spp. are a host of BYMV, however, no information regarding seed as a pathway in Cucurbita spp.
<i>Squash mosaic virus</i>	Reported in: CA, AZ, TX, AR, IL, WI, MI, AL, FL, NY, MA	None	ELISA per ISTA Seed Health Test Methods for cucurbits	Seed is a known pathway for SqMV in squash. The disease expression is generally mild in squash.

## **Lactuca**

- *Pseudomonas syringae pv syringae*
- *Rhodococcus fascians*
- *Alternaria brassicicola*
- *Arbis mosaic virus*
- *Lettuce mosaic virus*
- *Tobacco streak virus*

Pest	Distribution	Seed Treatment	Seed Test	Additional Notes
<i>Pseudomonas syringae</i>	Reported in: ID, CA, CO, GA, SC, WI, NY, NJ, AK	None	Selective media assay with pathogenicity	Pss is ubiquitous worldwide in soil, water and as an epiphyte. No references found indicating Lactuca is a host of Pss or that seed is a pathway for Pss in lettuce. Pss was recently listed on the lettuce ISF pest list which means a Phyto AD was recently made. Other pathovars of P. syringae do cause disease problems on lettuce.
<i>Rhodococcus fascians</i>	Reported in: WA, OR, CA, KS< OK, MO, IA, GA, MI, OH, IN, VA, MY, PA, NJ, NY, CN, MA	Hot-water treatment of Tropaeolum seeds (1 hour incubation in cold water, 30 minutes at 51.7°C, cool and	A selective medium has been described by Takayama et al. (1985).	There are very few references on this bacterium on Lactuca spp. There is no indication that the bacterium is associated with seed of Lactuca spp. R. fascians is on the lettuce ISF list so there have been Phyto AD requests for this bacterium on lettuce.



# AMERICAN SEED TRADE ASSOCIATION



		dry) eradicates R. fascians cells (Baker, 1950).		
Alternaria brassicicola	Reported in: OR, WA, CA, UT, OK, TX, NE, MN, IA, IN, FL, NC, VA, MY, PA, NJ, NY, CN, MA, NH	Aerated steam treatment of seeds resulted in significant improvements in seed health (Amein et al., 2011). Treatment of seed with fungicides such as iprodione is useful (Maude and Humpherson-Jones, 1980b; White, 1984; Humpherson-Jones, 1992).	PCR Iacomi-Vasilescu et al., 2002, Blotter (ISTA, 1965)	A. brassicicola is not a pathogen of lettuce, this fungus infects brassicas. Other species of Alternaria occur on Lactuca spp. A brassicicola is on the lettuce ISF pest list which means Phyto ADs for A. brassicicola has occurred needlessly on lettuce.
Arabis mosaic virus	Reported in: NE, MO, MI, OH, FL, CN	None	None	The information related to ArMV in vegetables is dated (1960s) and is based on limited experimental evidence. The original reference implicating seed transmission of ArMV in Lactuca sativa has a number of technical deficiencies. Current sources of information do not note the ArMV on vegetables. ArMV is on the lettuce ISF pest list which means Phyto AD received on lettuce.
Lettuce mosaic virus	Reported in: OR, WA, CA, CO, WI, SC, OH, PA, NY	One method of heat treatment which was shown to inactivate the virus without impairing seed germination is impractical for	A detailed step-by-step description of the Seminis Inc. ELISA procedure, standardized by the USA National Seed Health System (NSHS), can be	Seed is a known pathway for LMV in Lactuca spp. and all seedlots should be routinely tested.

# AMERICAN SEED TRADE ASSOCIATION



		routine use (Walkey and Dance, 1979).	accessed at <a href="http://www.seedhealth.org">www.seedhealth.org</a> .	
Tobacco streak virus	Reported in: OR, WA, CA, CO, WI, OH, ID, OK, MN, KT, MI, IA, FL, NC, MY	Treating dry seeds with trisodium phosphate prior to sowing reduces the risk of TMV infection (Pascual and Pérez Alfocea, 2011).	Seedborne TMV can be detected by inoculating a suspension of ground seeds on indicator hosts.	One report indicates <i>Lactuca</i> spp. infection by TSV. However, there is no indication that the problem is widespread. No references found indicating that seed is a pathway in <i>Lactuca</i> spp. It is on the lettuce ISF pest list which means Phyto AD have been received in lettuce. Seed is a pathway for TSV in some crops such as soybean, strawberry and some weeds.

## **Brassicae**

- *Pseudomonas syringae* pv. *syringae*
- *Pseudomonas viridiflora*
- *Albugo candida*
- *Alternaria brassicicola*
- *Alternaria dauci*
- *Alternaria japonica*
- *Gibberella avenacea*
- *Leptosphaeria maculans*

Pest	Distribution	Seed Treatment	Seed Test	Additional Notes
<i>Pseudomonas syringae</i> pv. <i>syringae</i>	in: ID, CA, CO, GA, SC, WI, NY, NJ, AK	None	Selective media assay with pathogenicity	Pss is ubiquitous worldwide in soil, water and as an epiphyte. Other pathovars of <i>P. syringae</i> cause disease on <i>Brassica</i> spp. No reports found of Pss causing disease in <i>Brassica</i> spp. Pss is on the <i>Brassica</i> ISF pest list which means a Phyto AD has been received on tomato.
<i>Pseudomonas viridiflora</i>	Not reported in: HI, WA, OR, IL, IA, IN, MN, SD, KS,	None	Selective media assay with pathogenicity	One report indicating that Chinese cabbage seed from Japan was contaminated with the bacterium. Not

# AMERICAN SEED TRADE ASSOCIATION



	TX, PA, FL			known to be a significant disease problem. <i>P. viridiflava</i> is on the brassica ISF pest list which means a Phyto AD has been received.
<i>Albugo candida</i>	Not reported in: AK, LA, TN, MI, MY, CN, RI	Chemical seed treatments are known to affect the incidence of disease caused by <i>A. candida</i> (Saharan and Verma, 1992; Mehta et al., 1996; Bhargava et al., 1997).	Washing briefly a 5 g seed sample of <i>B. rapa</i> in 10 ml of water containing a drop of Tween 20 and filtering the wash water through a millipore filter disc using suction. The filter disc was dried, cleared with mineral oil, the oospores of <i>A. candida</i> counted using a microscope, and the counts calculated as per seed basis	An oomycete that causes White Rust of crucifers. There is no evidence that seed is a pathway for <i>A. candida</i> in Brassica spp. It survives as oospores in soil and plant debris. On the Brassica ISF pest list which means a Phyto AD has been received.
<i>Alternaria brassicicola</i>	Reported in: OR, WA, CA, UT, OK, TX, NE, MN, IA, IN, FL, NC, VA, MY, PA, NJ, NY, CN, MA, NH	Hot-water soak treatment, although generally very efficient (>95%) at removing <i>A. brassicicola</i> , is not especially useful because only small lots can be treated and the seeds have to be dried afterwards (Nega et al., 2003). Aerated steam treatment of seeds resulted in significant improvements in seed health (Amein et al., 2011).	Blotter method (ISTA, 1965)	Seed is a known pathway for <i>A. brassicicola</i> in Brassica spp.

# AMERICAN SEED TRADE ASSOCIATION



<i>Alternaria dauci</i>	Reported in: CA, ID, NM, IL, WI, MI, OH, WV, NC, HI, NJ< NY, CN, MA	Seed treatment with HCl solution reduced infection by <i>A. dauci</i> , but with increasing concentration of HCl the number of dead seeds and healthy but ungerminated seedlings rose (Bralewski et al., 2004).	The PCR assay based on the specific primers developed seems to be a good alternative for the deep-freeze-blotter method and plating on ARSA, especially when time is an important issue (Konstantinova et al., 2002).	Brassica spp. are not a host of <i>A. dauci</i> . This species is specific to carrots and seed is a pathway on carrots. <i>A. dauci</i> was recently added to the ISF pest list which means Phyto AD has been received needlessly on Brassica spp.
<i>Alternaria japonica</i>	Reported in: CA, NM, MS, FL, OH, MN, MI, PA, NJ, MA	Many fungicides applied as a seed dressing are effective in reducing disease caused by <i>A. japonica</i>	Freeze/blotter assay as per ISTA "Common Laboratory Seed health Testing methods for Detecting Fungi"	Seed is a known pathway for <i>A. japonica</i> in Brassica spp.
<i>Gibberella avenacea</i>	Not reported in: HI, OR, IL, IA, IN, MN, OH, PA, MI, MO, KS, SD, TN, GA, DE	Thiram, TBZ, Prochloraz and Topsin were effectively used as seed dressers	Freeze/blotter assay as per ISTA "Common Laboratory Seed health Testing methods for Detecting Fungi"	<i>G. avenacea</i> has been reported on some crucifers such as rutabaga and canola, however, no reports found indicating that seed is a pathway in Brassica spp. This fungus is on the Brassica ISF pest list which means a Phyto AD has been received.
<i>Leptosphaeria maculans</i>	Reported in: OR, WA, CA, ND, WI, IL, KT, GA, NY, HI	Ahamad et al. (2003) reported that seed treatments of Bavistin and Jkstein (both at 2 g/kg seed) both eliminated <i>L. maculans</i> from the seeds of rapeseed mustard	Blotter (ISTA, 1965)	Seed is a known pathway for <i>L. maculans</i> in all Brassica spp.

## Cucumis

- *Acidovorax citrulli*
- *Pseudomonas syringae pv. lachrymans*
- *Pseudomonas syringae pv syringae*
- *Pseudomonas viridiflora*
- *Rhodococcus fascians*
- *Alternaria brassicicola*
- *Alternaria dauci*
- *Gibberella avenacea*
- *Arabid mosaic virus*
- *Squash mosaic virus*
- *Tobacco streak virus*

Pest	Distribution	Seed treatment	Seed Test	Additional Notes
<i>Acidovorax citrulli</i>	Reported in: OR CA, OK, TX, IA, MO, AR, MS, AL, GA, FL, SC, NC, IL, IN	None for cucumis family	A detailed step-by-step description of the Seminis Inc. PCR-Wash procedure, standardized by the USA National Seed Health System (NSHS) can be accessed at the website <a href="http://www.seedhealth.org">www.seedhealth.org</a> .	Seed is a known pathway for Aac in Cucumis melo. Not know to occur in C. sativus.
<i>Pseudomonas syringae pv lachrymans</i>	in: ID, CA, CO, GA, SC, WI, NY, NJ, AK	Disinfection of cucumber seeds by dry heat at 70°C or by hot-water treatment at 52°C for 10 minutes or 54°C for 5 minutes gave excellent control of P. lachrymans and only slightly reduced	An SDS-PAGE electrophoresis technique for detection of seedborne P. syringae pv. lachrymans has been reported (Scortichini, 1992).	Seed transmitted in cucumber.

		percentage germination (Umekawa and Watanabe, 1978). Another report indicated that seed treatment with hot water (53°C for 60 minutes) and steam (85°C for 60 minutes) reduced infection of cotyledons from 89.4-6 to 6.3-6.6%.		
<i>Pseudomonas viridiflora</i>	Not reported in: HI, WA, OR, IL, IA, IN, MN, SD, KS, TX, PA, FL	none	Selective media assay with pathogenicity	This bacterium has been reported on melon and cucumber but is limited in its distribution. There is no information regarding seed as a pathway in melon or cucumber. <i>P. viridiflora</i> is on the ISF melon and cucumber pest list which means Phyto AD requests have been made.
<i>Rhodococcus fascians</i>	Reported in: WA, OR, CA, KS< OK, MO, IA, GA, MI, OH, IN, VA, MY, PA, NJ, NY, CN, MA	Hot-water treatment of <i>Tropaeolum</i> seeds (1 hour incubation in cold water, 30 minutes at 51.7°C, cool and dry) eradicates <i>R. fascians</i> cells (Baker, 1950).	A selective medium has been described by Takayama et al. (1985).	There are very few references on this bacterium on melons or cucumbers. There is no indication that the bacterium is associated with seed in melons or cucumbers. <i>R. fascians</i> is not on the cucumber ISF list but is on the melon ISF pest list. So there have been Phyto AD requests for this bacterium on melon.
<i>Alternaria brassicicola</i>	Reported in: OR, WA, CA, UT, OK, TX, NE, MN, IA,	Hot-water soak treatment, although generally very	Blotter method (ISTA, 1965)	<i>A. brassicicola</i> is not a pathogen of melon or cucumber, this bacterium infect brassicas. Other species

	IN, FL, NC, VA, MY, PA, NJ, NY, CN, MA, NH	efficient (>95%) at removing <i>A. brassicicola</i> , is not especially useful because only small lots can be treated and the seeds have to be dried afterwards (Nega et al., 2003). Aerated steam treatment of seeds resulted in significant improvements in seed health (Amein et al., 2011).		of <i>Alternaria</i> occur on <i>Cucumis</i> spp. <i>A. brassicicola</i> is on both the melon and cucumber ISF pest list which means Phyto Ads for <i>A. brassicicola</i> has occurred needlessly in cucumber and melon.
<i>Alternaria dauci</i>	Reported in: CA, ID, NM, IL, WI, MI, OH, WV, NC, HI, NJ< NY, CN, MA	Seed treatment with HCl solution reduced infection by <i>A. dauci</i> , but with increasing concentration of HCl the number of dead seeds and healthy but ungerminated seedlings rose (Bralewski et al., 2004).	The PCR assay based on the specific primers developed seems to be a good alternative for the deep-freeze-blotter method and plating on ARSA, especially when time is an important issue (Konstantinova et al., 2002).	<i>A. dauci</i> is not a pathogen of melon or cucumber, it infects carrots primarily. Other species of <i>Alternaria</i> occur on <i>Cucumis</i> spp. <i>A. dauci</i> is recently on cucumber ISF pest list which means Phyto Ads for <i>A. dauci</i> have occurred needlessly in cucumber. The only report of cucumber as a host is from experimental inoculations of seedlings reported in 1945.
<i>Gibberella avenacea</i>	Not reported in: HI, OR, IL, IA, IN, MN, OH, PA, MI, MO, KS, SD, TN, GA,DE	Thiram, TBZ, Prochloraz and Topsin were effectively used as seed dressers	Freeze/blotter assay as per ISTA "Common Laboratory Seed health Testing methods for Detecting Fungi"	The fungus is a ubiquitous soilborne pathogen. <i>Cucumis</i> spp. fruit are susceptible to infection by the <i>Fusarium</i> state of <i>G. avenacea</i> . Some references make general statements that it may be seedborne but no references were found proving that seed is a pathway in <i>Cucumis</i> spp. It can be seedborne on grains

				and clover. It is on the melon ISF pest list and listed as "pathway not proven".
<i>Arabid mosaic virus</i>	Reported in: NE, MO, MI, OH, FL, CN	None	None	The information related to ArMV in vegetables is dated (1960s) and is based on limited experimental evidence. Current sources of information do not note the ArMV on vegetables. Listed on the cucumber ISF pest list which means Phyto AD received on cucumber. Not on the melon ISF pest list.
<i>Squash mosaic virus</i>	Reported in: CA, AZ, TX, AR, IL, WI, MI, AL, FL, NY, MA	None	None for <i>cucumis</i>	Seed is a known pathway for SqMV in melon and all seed lots should be routinely tested. However, it is not known to be seed transmitted in cucumber.
<i>Tobacco streak virus</i>	Reported in: OR, WA, CA, CO, WI, OH, ID, OK, MN, KT, MI, IA, FL, NC, MY	Treating dry seeds with trisodium phosphate prior to sowing reduces the risk of TMV infection (Pascual and Pérez Alfocea, 2011).	Seedborne TMV can be detected by inoculating a suspension of ground seeds on indicator hosts. ELISA tests have been used to detect tobamoviruses in tomato, aubergine and pepper seeds (Cicek and Yorganci, 1991).	C. melo is not known to be a host of TSV. There is one reference indicating infection on cucumber in India. However, there are no indications that seed is a pathway for TSV in cucumber. TSV is on both the melon and cucumber ISF pest list which means Phyto AD has been received. Seed is a pathway for TSV in soybean, strawberry and some weeds.

**Citrullus**

- *Acidovorax citrulli* (BFB)
- *Pseudomonas viridiflora*
- *Squash mosaic virus*

Pest	Distribution	Seed Treatment	Seed Test
<i>Acidovorax citrulli</i>	Reported in: OR CA, OK, TX, IA, MO, AR, MS, AL, GA, FL, SC,	None for citrullus family	A detailed step-by-step description of the Seminis Inc. PCR-



# AMERICAN SEED TRADE ASSOCIATION



	NC, IL, IN		Wash procedure, standardized by the USA National Seed Health System (NSHS) can be accessed at the website <a href="http://www.seedhealth.org">www.seedhealth.org</a> .
<i>Pseudomonas viridiflora</i>	Not reported in: HI, WA, OR, IL, IA, IN, MN, SD, KS, TX, PA, FL	none	Selective media assay with pathogenicity
<i>Squash mosaic virus</i>	Reported in: CA, AZ, TX, AR, IL, WI, MI, AL, FL, NY, MA	None	None for Citrullus

## **Festuca**

- *Monographella nivalis*
- *Neotyphodium coenophialum*
- *Pyrenophora chaetomioides*
- *Pyrenophora tetacirepentus*
- *Urocystis agropyri*
- *Anguina agrostis*

Pest	Distribution	Seed Treatment	Seed Test
<i>Monographella nivalis</i>	Reported in: OR, WA, CA, ID, ND, WI, MI, NY, MY	None for <i>festuca</i>	Blotter test, Culture Plate
<i>Neotyphodium coenophialum</i>	Not reported in: NV, AZ, ID, MY, WY, ND, SD, NE, MN, IA, MI, PA, NY, DE, CN, VT, NH, ME, RI	Treatment of <i>N. coenophialum</i> -infected seeds with fungicides including triadimenol, triadimefon and propiconazole resulted in nearly complete elimination of viable endophyte when the seeds were planted in the greenhouse (Siegel et al., 1984b).	Polymerase chain reaction (PCR) (Doss and Welty, 1995)
<i>Pyrenophora</i>	Reported in: TX, AR	Triadimenol and	Identifiable using a

# AMERICAN SEED TRADE ASSOCIATION



<i>chaetomoiades</i>		thiram plus carboxin-containing fungicides will protect the seed to some extent although they are not completely effective.	blotter or agar culture test (PDA or MEA) on seed. The fungus grows on a standard agar at 20°C. Colony diameter will usually be 2-6 cm after 7 days (Neergaard, 1977).
<i>Pyrenohora tetacirepentus</i>	Nothing on the Internet		
<i>Urocystic agropyri</i>	Not reported in: KT, NC, SC, GA, FL, AL, DE, ME, TX, HI	Flag smut of wheat has ceased to be a problem in the regions where seed treatment with systemics is routine practice for its control.	Freeze/blotter assay as per ISTA "Common Laboratory Seed health Testing methods for Detecting Fungi"
<i>Anguina agrostis</i>	Not reported in: IA, MO, IL, ID, OH, WV, KT	Not a plant pathogen	Not a plant pathogen

## ***Panicum***

- *Acidovorax citrulli*
- *Pseudomonas syringae pv syringae*
- *Maize dwarf mosaic virus*

Pest	Distribution	Seed Treatment	Seed Test
<i>Acidovorax citrulli</i>	Reported in: OR CA, OK, TX, IA, MO, AR, MS, AL, GA, FL, SC, NC, IL, IN	None for panicum family	A detailed step-by-step description of the Seminis Inc. PCR-Wash procedure, standardized by the USA National Seed Health System (NSHS) can be accessed at the website <a href="http://www.seedhealth.org">www.seedhealth.org</a> .
<i>Pseudomonas syringae pv syringae</i>	Reported in: ID, CA, CO, GA, SC, WI, NY, NJ, AK	none	Selective media assay with pathogenicity
<i>Maize dwarf mosaic virus</i>	Not reported in: MT, WY, UT, NV, AZ, ORG,	None	Iowa State University Seed Health Testing

# AMERICAN SEED TRADE ASSOCIATION



	CO,		Laboratory has adapted a diagnostic kit manufactured by Agdia Inc, Elkhart, Indiana, USA, to test for MDMV in seeds. The method is available on the USDA National Seed Health System website, <a href="http://www.seedhealth.org">www.seedhealth.org</a>
--	-----	--	--

## **Cynodon**

- *Pseudomonas syringae pv pisi*
- *Pseudomonas syringae syringae*
- *Rathoyibacter rathagi*
- *Balansia oryzae sativa*
- *Cochliobolus spicifer*
- *Glomerella Graminicol*
- *Phaeospheria nodorum*

Pest	Distribution	Seed Treatment	Seed Test
<i>Pseudomonas syringae pv pisi</i>	Reported in: WA, CA, CO, KS, WI	None for <i>cynodon</i>	ELISA (Möllenbruck and Sander, 1991)
<i>Pseudomonas syringae syringae</i>	in: ID, CA, CO, GA, SC, WI, NY, NJ, AK	None	Selective media assay with pathogenicity
<i>Rathoybicater rathagi</i>	Reported in: OR, VA	None	None
<i>Balansia oryzae sativa</i>	Reported in: LA, FL	Seed treatment with hot water at 54°C for 10 minutes	Blotter method (Misra et al., 1994a)
<i>Cochliobolus spicifer</i>	Reported in: NE, TN	None for <i>cynodon</i>	Standard ISTA techniques can be used (eg. Banerjee et al., 2011).
<i>Glomerella graminicol</i>	Not reported in: NV, NM, UT, TN, VT, NH, ME, RI	None for <i>cynodon</i>	Blotter (Yap and Kulshrestha, 1975)

# AMERICAN SEED TRADE ASSOCIATION



<i>Phaespheria nodorum</i>	Not reported in: NE, AZ, ME, VT, NH, CN, RI, HI	Warm-water treatment was equally or more effective than the fungicides at controlling P. nodorum (Winter et al., 1994).	Blotter (Lagerberg et al., 1995)
----------------------------	---	---	----------------------------------

## **Lolium**

- *Furarium culmorum*
- *Gibberella avenacea*
- *Monographella nivalis*
- *Phaeosphaeria nodorum*
- *Urocystis agropyri*
- *Angiuna agrostis*

Pest	Distribution	Seed Treatment	Seed Test
<i>Furarium culmorum</i>	Reported in: WA, OR, CA, ID, MN	<i>F. culmorum</i> has shown high sensitivity to <i>Streptomyces antimycoticus</i> FZB53, a biocontrol agent, when applied as a seed treatment (Koch and Loffler, 2009). Riccioni and Orzali (2011) conclude that the oils of tea tree ( <i>Melaleuca alternifolia</i> ) and thyme ( <i>Thymus vulgaris</i> ) could be considered as natural fungicides to control and prevent seed-borne instances of <i>F. culmorum</i> .	None Reported
<i>Gibberella avenacea</i>	Not reported in: HI, OR, IL, IA, IN, MN, OH, PA, MI, MO, KS, SD, TN, GA, DE	Thiram, TBZ, Prochloraz and Topsin were effectively used as seed dressers	Freeze/blotter assay as per ISTA "Common Laboratory Seed health Testing methods for Detecting Fungi"
<i>Monographella nivalis</i>	Reported in: OR, WA, CA, ID, ND, WI, MI, NY, MY	None for <i>lolium</i>	Blotter test, Culture Plate
<i>Phaeosphaeria</i>	Not reported	Warm-water treatment was	Blotter (Lagerberg

# AMERICAN SEED TRADE ASSOCIATION



<i>nodorum</i>	in: NE, AZ, ME, VT, NH, CN, RI, HI	equally or more effective than the fungicides at controlling P. <i>nodorum</i> (Winter et al., 1994).	et al., 1995)
<i>Uroystis agropyri</i>	Not reported in: KT, NC, SC, GA, FL, AL, DE, ME, TX, HI	Flag smut of wheat has ceased to be a problem in the regions where seed treatment with systemics is routine practice for its control.	Freeze/blotter assay as per ISTA "Common Laboratory Seed health Testing methods for Detecting Fungi"
<i>Angiuna agrostis</i>	Reported in: WA, OR, MN, VA	Hot-water treatment of infested seeds at 52°C for 15 minutes, after a 2-hour pre-soak in tepid water, controls nematodes and reduces germination by only 5%. However, hot-water treatment is effective only when the galls are 'naked', not covered by inner paleae of the inflorescence (Christie, 1959).	Visual examination