Ministry for Primary Industries
Manatū Ahu Matua

Risk Management Proposal:

Amendment to the G*rain and Seeds for Consumption, Feed, or Processing* import health standard

GCFP.IHS

Prepared for public consultation by the Animal and Plant Health Directorate

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New Zealand Government

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1 General information

1.1 Purpose

(1) The purpose of this document is to:

a) Provide relevant background information about the import health standard for grains and seeds for consumption, feed, or processing (the standard),
b) Identify the proposed amendments to the standard,
c) Provide the rationale for the proposed amendments, and risk management measures and how they manage risk,
d) Seek feedback on the proposed amendments to the standard.

(2) The subject of public consultation is the specific amendments proposed in the draft standard. This risk management proposal supports the draft standard and should be read in conjunction with the draft standard, to understand the rationale behind the proposed import requirements. The risk management proposal itself is not the subject of public consultation.

1.2 Background

(3) The standard applies to grains and seeds for consumption, feed, or processing that are imported into New Zealand from foreign countries and territories.

(4) The standard sets out risk mitigations measures for the importation of 'Basic' seeds (as specified in the Plants Biosecurity Index (PBI) and other seeds with specific schedules, for the purposes of consumption, feed, and processing.

(5) The standard was last issued on 4 February 2021, under section 24A of the Biosecurity Act 1993 (the Act), incorporating amendments made in accordance with section 24B(1)(a) of that Act.

1.3 Timing and consultation

(6) The proposed amendment to the import health standard *Grain and Seeds for Consumption, Feed, or Processing* was released for consultation on 05 September 2022 and will remain open for consultation until 17 October 2022.

1.4 Background and context of consultation

1.4.1 International regulation of risk goods

(7) "The World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) sets in place rules that protect each country's sovereign right to take the measures necessary to protect the life or health of its people, animals, and plants, while at the same time facilitating trade. It embodies and promotes the use of science-based risk assessments to manage the risks associated with the international movement of goods. The SPS Agreement guides how New Zealand sets standards and makes decisions related to biosecurity." (MAF et al., 2009, p. 1)

(8) "In particular, [it is] important to maintain the standards of transparency and scientific rigour required by the SPS Agreement and to make decisions as quickly as possible. This will encourage other countries to comply with the rules of the SPS Agreement and also demonstrate that New Zealand's strict controls are justified to countries that challenge them." (MAF et al., 2009, p. 13)

1.4.2 Domestic regulation of biosecurity risks associated with importing risk goods

(9) The New Zealand biosecurity system is regulated through the Biosecurity Act 1993 (the Act). Section 22 of the Act describes an import health standard and requires all risk goods imported into New Zealand to be managed by the import health standard.

(10) MPI is the New Zealand government ministry responsible for maintaining biosecurity standards for the effective management of risks associated with the importation of risk goods and craft into New Zealand (Part 3, the Act).

(11) MPI is committed to the principles of transparency and evidence-based technical justification for all phytosanitary measures, new and amended, imposed on importing pathways. MPI periodically reviews all import health standards, related documents, and other standards so that the legal requirements are clear, and information is easy to understand.

2 Proposed changes to the standard

(12) MPI aims to manage biosecurity risks on the grain import pathway to achieve an appropriate level of protection for New Zealand, whilst facilitating trade of economically important commodities. This will be achieved by proposing the following amendment to the standard:

a) remove phytosanitary requirements for specific pests in the *Panicum* schedule
b) develop a new schedule for *Brassica napus*
c) develop a new schedule for *Pennisetum glaucum* and *P. clandestinum*
d) minor changes to the ISTA sampling wordings to clarify ambiguities

2.1 Removal of phytosanitary measures for specific pests in the *Panicum* schedule

2.1.1 Background

(13) New Zealand does not grow *Panicum* spp. commercially (NZGSTA, 2022). *Panicum* spp. seeds are imported for consumption, feed or processing under the *Panicum* spp. schedule of the Standard. There are four options for the import of *Panicum* seeds. The first two options involve treatment (either overseas or in New Zealand) to render the grains non-viable. The third option involves processing of untreated grains in an approved transitional facility to render them non-viable. Under option four, viable grains can receive biosecurity clearance on arrival.

(14) This amendment involves grains imported under Options 3 (processing in New Zealand) and 4 (clearance on arrival). The phytosanitary measures for import under these two options, require that *Panicum* grains:

a) must be sourced from an area where named regulated pests are not known to occur;
b) must be sourced from an arable crop that has been inspected during the growing season and named regulated pests were not detected; or
c) representative samples of the grains were tested at an approved diagnostic laboratory and found to be negative for named regulated pests.

(15) Currently, there are 45 pests listed in the *Panicum* spp. schedule that require the above-mentioned phytosanitary requirements. This list consists of 43 fungi, one nematode and one virus.

2.1.2 Proposed change to the *Panicum* schedule

(16) MPI proposes removing the phytosanitary measures for 37 pests in the *Panicum* schedule because there is insufficient evidence to support continuing their regulation (see amended Schedule in Appendix 1 A).

2.1.3 Rationale for proposed change

(17) It can be financially challenging for exporters to devote resources (through surveillance) to maintain an area's freedom status, undertake field inspections to determine production area freedom for 45 pests, or test consignments for these pests. Some of these pests are of minor significance, or there is not sufficient evidence that these pests are associated with *Panicum* seeds.

(18) To enable trade while protecting New Zealand from biological risks, MPI reviewed the 45 regulated pests on the *Panicum* spp. schedule. We wanted to ensure that we are only regulating important pests on this pathway that can establish in New Zealand. We also wanted to ensure there is sufficient evidence to support the application of phytosanitary measures.

(19) In our review, we considered each pest, whether it is seed-borne and can be transmitted through seed, its significance and the suitability of the New Zealand climate for it to establish a population.

(20) We considered technical information (MPI 2004, MPI 2021a) and scientific reports related to the pests. We used this information to assess the justification for the current import requirements for these pathogens in the *Panicum* spp. schedule. We concluded that the continued regulation of some of the pests is unjustified and that the *Panicum* spp. schedule should be amended to remove requirements for those pests after consultation with stakeholders.

2.1.4 Pathogens to be removed from *Panicum* spp. schedule

(21) MPI proposes removing phytosanitary requirements for 37 pests (Table 1) listed in the *Panicum* spp. schedule. There is insufficient evidence to support including measures to manage these pests in the *Panicum* spp. schedule.

(22) The pests meet one or more of the following criteria:

a) The pest is present in New Zealand.
b) The pest is not associated with *Panicum* seeds or is not seed-borne and/or not seed-transmitted.

c) The pest is of minor significance for *Panicum* spp., and New Zealand climatic conditions may restrict its establishment.

Table 1. Regulated pests being removed from the *Panicum* spp. schedule and reason for removal

P	Pest	Present in NZ	Seed-borne (SB) or seed-transmitted (ST)	Reason for removal
1	*Alternaria saparva*	-	SB	Minor significance
2	*Aspergillus tamarii*	Yes	N*	*Panicum* not a host
3	*Balansia andropogonis*	-	N	No evidence of association with *Panicum* seeds
4	*Balansia henningsiana*	-	N	Minor significance
5	*Balansia pallida*	-	N	No evidence of association with *Panicum* seeds
6	*Balansia sclerotica*	-	N	No evidence of association with *Panicum* seeds
7	*Balansia strangulans*	-	N	Minor significance, only parts of North Island have suitable climate
8	*Bipolaris panici-miliacei*	-	N	Minor significance
9	*Bipolaris urochloae*	Yes	SB	Minor significance, New Zealand climate not suitable
10	*Claviceps africana*	-	N	No evidence of association with *Panicum* seeds; *Sorghum* is main host
11	*Claviceps fusiformis*	-	N	No evidence of association with *Panicum* seeds; New Zealand climate not suitable
12	*Claviceps maximensis*	-	N	Minor significance; New Zealand climate not suitable
13	*Claviceps sorghi*	-	N	No evidence of association with *Panicum* seeds; New Zealand climate not suitable
14	*Cochliobolus setariae*	-	N	Minor significance
15	*Gloeocercospora sorghi*	-	N	New Zealand climate not suitable
16	*Melanomma panici-miliacei*	-	N	Minor significance
17	*Panicum mosaic virus*	-	N	New Zealand climate not suitable; limited host range
18	*Peronosclerospora graminicola*	-	N	No evidence of association with *Panicum* seeds

19	*Peronosclerospora sorghi*	-	N	No evidence of association with *Panicum* seeds
20	*Sorosporium afrum*	-	N	Minor significance
21	*Sorosporium cryptum*	-	N	Minor significance
22	*Sorosporium formosanum*	-	N	Minor significance
23	*Sorosporium harrismithense*	-	N	Minor significance
24	*Sorosporium panici*	-	N	Minor significance; New Zealand climate not suitable
25	*Sphacelotheca digitariae*	-	N	Minor significance
26	*Sphacelotheca veracruziana*	-	N	Minor significance
27	*Sporisorium cenchri*	-	N	Minor significance
28	*Sporisorium sorghi*	-	N	No evidence of association with *Panicum* seeds; seed-borne on *Sorghum*
29	*Tilletia ayresii*	-	N	Minor significance
30	*Tilletia barclayana*	-	N	*Oryza sativa* is main host; *Panicum* is secondary host
31	*Tilletia biharica*	-	N	Minor significance
32	*Tilletia courtetiana*	-	N	Minor significance
33	*Tilletia maclagani*	-	N	Minor significance
34	*Tilletia narayanaraoana*	-	N	Minor significance
35	*Tilletia tumefaciens*	-	N	Minor significance
36	*Tilletia verrucosa*	-	N	Minor significance
37	*Ustilago heterogena*	-	N	Minor significance

* N = no evidence, or neither seed-borne nor seed-transmitted on *Panicum*

(23) In addition to removing the pathogens listed on Table 1, MPI proposes making the following changes to the *Panicum* spp. schedule:

a) Replacing Sorosporium manchuricum and Sporisorium destruens (mistakenly listed in the standard as Sorosporium destruens) with the synonym Anthracocystis destruens, which is the current and preferred name (McTaggart et al. 2012; Farr et al. 2022).

2.1.5 Pathogens that will stay in the *Panicum* spp. schedule

(24) The pests listed in Table 2 will stay in the *Panicum* spp. schedule. These pests pose biosecurity risks to New Zealand.

a) They are not present in New Zealand.
b) They are seed-borne or seed-transmitted.
c) They are significant pests of *Panicum* or other New Zealand hosts, and the New Zealand climate is suitable for them to establish a population.

Table 2. Regulated pests that will stay in the *Panicum* spp. schedule and their significant characteristics that warrant a measure

	Regulated pest	Characteristics
1	*Anthracocystis destruens* (syn.: *Sorosporium manchuricum* and *Sporisorium destruens*)	This fungal pathogen does not appear to be established in New Zealand (technical advice from risk, pers. comm. Merje Toome). It is seed-borne and appears to be a serious pest of *Panicum* sp. (Zhou et al. 2016). The New Zealand climate is suitable for its establishment.
2	*Aphelenchoides besseyi*	This nematode is not present in New Zealand. It is seed-borne and seed-transmitted on *Panicum maximum* (Garcia et al., 2000). It can survive in a state of anhydrobiosis for several years on stored grain. The nematode is found on numerous ornamental plants and also on grasses (CABI, 2022). Significant New Zealand hosts for the nematode are *Ipomoea batatas*, *Allium cepa, Zea mays* and *Fragaria* sp. The climate in the North Island is suitable for its establishment (MPI, 2004).
3	*Balansia claviceps*	This fungal pathogen is not present in New Zealand. It is systemic in its host and thus most likely seed-borne (MPI, 2004). It is a significant pest on *Panicum* spp. (Lenne 1990), *Setaria* spp. and *Pennisetum* spp. (Index Fungorum 2021). The New Zealand climate, mainly in the North Island, is suitable for its establishment (MPI, 2004).
4	*Balansia epichloe*	This fungal pathogen is not present in New Zealand. It is systemic in its host and thus most likely seed-borne (MPI, 2004). It is a significant pest on *Panicum* spp., *Eragrostis hirsuta* and *Festuca* spp. It can poison animals that eat infected seeds (Phillips, 1993). The New Zealand climate, mainly in the North Island, is suitable for its establishment (MPI, 2004).
5	*Balansia oryzae-sativae*	This fungal pathogen is not present in New Zealand. It is systemic in its host and thus most likely seed-borne (MPI, 2004). It is a significant pest on *Panicum* spp., *Cynodon dactylon, Eragrostis tenuifolia, Setaria* spp. and *Pennisetum* spp. The fungus might affect native grasses and pasture and thus is of some environmental concern. It also can poison animals feeding on infected pasture (Phillips, 1993). The New Zealand climate, mainly in the North Island, is suitable for its establishment (MPI, 2004).
6	*Cochliobolus pallescens*	This fungal pathogen is not present in New Zealand. It is seed-borne. It is an important pest of many commercial *Poaceae* crops, particularly those grown for grain (Manamgoda et al. 2011). Significant New Zealand hosts are *Zea mays*, *Capsicum* spp., *Corchorus capsularis*, *Eleusine coracana*, *Eleusine indica*, *Imperata cylindrica*, *Asparagus officinalis, Dioscorea*

		spp., *Citrus* spp., *Triticum* spp. and *Callistephus chinensis*. The climate in the North Island is suitable for its establishment (MPI, 2004).
7	*Ustilago crameri*	This fungal pathogen is not present in New Zealand. It is seed-borne. It is an important pest of *Panicum* spp. (Lenne 1990) and *Pennisetum* spp. (Kumar 2011). The climate in the North Island is suitable for its establishment (MPI, 2004).

(25) The phytosanitary measures are then required for pests listed in Table 2 when *Panicum* spp. seeds are imported under option 3 or 4 of the standard.

(26) While New Zealand does not grow *Panicum* spp. commercially (NZGSTA, 2022), some of the plants that are co-hosts or secondary hosts for *Panicum* pathogens are typically grown in the North Island where climatic conditions are considered suitable for establishment of *Panicum* pathogens. Measures for *Panicum* spp. seeds are justified for the pests listed in Table 2 if the seeds are imported under options 3 and 4 of the standard.

2.1.6 Feasibility and consequences of the proposed change

(27) The proposed changes would remove an existing requirement for an additional declaration to the phytosanitary certificate for pests specified in Table 1 for *Panicum* spp. seeds.

(28) The proposed change will facilitate trade by removing a potential barrier to an offshore national plant protection organisation (NPPO) issuing an additional declaration on a phytosanitary certificate for the pests proposed to be removed from the *Panicum* spp. schedule.

(29) The proposed changes do not affect other requirements of the standard and will not impose additional costs on New Zealand importers.

2.2 New schedule for *Brassica napus*

(30) The standard does not currently specify import requirements for importing *Brassica napus* (oilseed rape, canola, swede) seeds. MPI proposes adding a schedule for *B. napus* with biosecurity requirements for importing these seeds. The schedule will have three import options.

2.2.1 Background

(31) *B. napus* seeds have been imported for processing for many years. Previously, seeds were imported under Part 3.8 of the standard *Stored Plant Products for Human Consumption* (SPP.HUMAN.IHS) and could only be processed in an approved transitional facility. The import requirements were specified on the permit.

(32) Currently, imports of *B. napus* seeds for processing are facilitated by the direction issued by a chief technical officer, which directs seeds into a transitional facility for processing under a valid permit. The direction was given on the basis that:

a) there were no known biosecurity risks associated with *B. napus* seeds, based on the rapid risk assessment for *Brassica* pathogens (MPI, 2013);
b) the *B. napus* schedule in the standards *Seeds for Sowing* only sets requirements to manage the risk of genetically modified (GM) seeds being introduced into New Zealand; and
c) sending *B. napus* seeds for processing to a transitional facility and processing them to render them non-viable will manage all biosecurity risks associated with the imported seeds.

2.2.2 Proposed import options in new *Brassica napus* schedule

(33) The full text of the proposed schedule is in Appendix 1 B. We are proposing three import options.

Option 1: Importing seeds that have been devitalised in the country of origin

This option is for importing non-viable seeds. Seeds must be treated in the country of origin. They must be heat treated (at 85°C and 40% RH for a minimum of 15 hours) or irradiated (at a dose of 25 KGy) to devitalise the seeds. Irradiated seeds cannot be used for human consumption. The phytosanitary certificate must have an endorsement from the exporting NPPO that the seeds have been treated and the consignment contains no viable seeds. MPI may check consignments for seed viability consignments on arrival to verify the phytosanitary certificate.

Option 2: Importing seeds to be treated in New Zealand

This option is for importing viable seeds. Seeds must be treated after arrival in a transitional facility approved for this purpose. They must be heat treated (at 85°C and 40% RH[1] for a minimum of 15 hours) or irradiated (at a dose of 25 KGy) to devitalise the seeds.

Option 3: Importing seeds for processing in New Zealand

This option is for importing viable seeds for destructive processing. Seeds must be processed at a transitional facility approved for this purpose. The processing must be destructive and render the seeds non-viable.

(34) All consignments must have a phytosanitary certificate stating that the seeds have been inspected and found free of any visually detectable live regulated pests.

(35) Only non-viable *Brassica napus* seeds will be eligible for biosecurity clearance.

(36) At this stage, and with our current information, we are not including an option to import seeds for biosecurity clearance on arrival at the New Zealand border. This is explained in section 2.2.3.

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[1] Relative humidity

2.2.3 Rationale and risk management for the proposed new schedule

(37) MPI identified 24 pests associated with *B. napus* seeds (seed-borne (internally or externally) or seed-transmitted). Most of these pests are already present and established in New Zealand (Appendix 2 B) (MPI, 2021b).

(38) Out of the 24 pests, MPI concluded that the following are a hazard on *B. napus* seeds:

<u>Bacteria:</u>

- *Xanthomonas campestris* pv. *aberrans*
- *X. campestris* pv. *armoraciae*
- *X. campestris* pv. *raphanin*

<u>Viruses:</u>

- *Turnip yellow mosaic virus*

<u>Fungi:</u>

- *Alternaria ethzedia*

(39) These pests are hazards because they are seed-borne on *B. napus* seeds and are not present in New Zealand. The proposed new schedule does not provide a mechanism for these pests to reach vulnerable hosts and be introduced to the New Zealand environment.

a) The treatment options in the proposed schedule (option 1 and 2) are heat treatment at 85°C and 40% RH for a minimum of 15 hours or irradiation at 25 KGy. Heat treatment devitalises seeds and kills and inactivates organisms that are associated with the seeds and pose a biosecurity risk. Irradiation devitalises seed and damages the microorganisms' DNA, which kills them or makes them incapable of multiplying.

b) Bacteria and viruses in seeds can only establish a population if the seeds grow. Viruses and bacteria do not spread through non-viable seeds. The proposed requirements ensure that seeds will be non-viable after treatment or processing and unable to grow.

c) Although fungal pathogens may survive being ground up, it is highly unlikely that significant amounts of inoculum (viable spores or mycelium) will survive destructive processing in a transitional facility and be released into the New Zealand environment near suitable hosts.

d) The end use of the seeds (consumption) minimises any residual risk. Seeds imported for processing or consumption are unlikely to be planted or distributed in the wider environment. Commercial seed growers want confidence that the seeds they plant are healthy, and so they usually plant certified seeds from commercial seed suppliers.

(40) Under the proposed new schedule, viable *B. napus* seeds cannot be imported to be cleared on arrival. To allow this, we would need to conduct further risk assessment to better understand the likelihood of these pests entering New Zealand on *B. napus* seeds, becoming exposed to a suitable host or environment and establishing a population. We would also need to assess the impact of these pests on the *Brassica* seed industry. We may assess this in the future.

2.2.4 Feasibility and consequences of the proposed change

(41) The proposed new schedule will provide more options for importing *B. napus*. The proposed requirements in options 1, 2 and 3 have been successful so far in facilitating trade for other seeds and have kept the biosecurity risk to New Zealand low.

(42) The proposed requirements are not new. These seeds are currently imported under a CTO direction. Facilities that import *B. napus* seeds for processing are already accredited to the appropriate MPI facility standard (usually *General Transitional Facilities for Uncleared Goods* (MPI-STD-TFGEN)), and the biological risks associated with the imported seeds are managed.

(43) There will be some additional costs to import seeds under the new import options (e.g., phytosanitary certificate). However, it is still feasible for importers to comply with this requirement, and the benefits of the proposed schedule outweigh the financial cost. The new options will give importers more flexibility with how they import *B. napus* seeds.

(44) The proposed new schedule even reduces import costs for importers who are importing *B. napus* seeds for processing, because we have also removed the permit requirement for import of seeds.

2.3 New schedule for *Pennisetum glaucum* and *P. clandestinum*

2.3.1 Background

(45) Currently, *Pennisetum glaucum* and *P. clandestinum* whole seeds cannot be imported for consumption or feed. MPI has been asked to add a new schedule to the standard so that *Pennisetum glaucum* and *P. clandestinum* seeds can be imported for consumption. We have agreed to add this, and we are proposing two options to import these seeds.

(46) Before we add a new schedule to a standard, we usually identify the hazards and conduct a full risk assessment. However, hazard identification and risk assessment for pests associated with *Pennisetum glaucum* and *P. clandestinum* are not current priorities for MPI for 2022–2023. Given that the request is only to import treated seeds and seeds to be treated on arrival, we propose issuing this schedule with limited import options as explained below.

2.3.2 Proposed import options in new *Pennisetum glaucum* and *P. clandestinum* schedule

(47) The full text of the proposed schedule is in Appendix 1 C. We are proposing two import options.

<u>Option 1: Importing seeds devitalised in the country of origin</u>

This option is for importation of non-viable seeds. Seeds must be heat treated (at 85°C and 40% RH for a minimum of 15 hours) or irradiated (at a dose of 25 KGy) at the country of origin to devitalise the seed. An endorsement from the exporting NPPO stating that the seeds were treated, and the consignment contains no viable seeds will need to be included on the phytosanitary certificate. An audit for seed viability may be conducted on consignments on arrival to verify the phytosanitary certificate.

<u>Option 2: Importing seeds to be treated in New Zealand</u>

Viable seeds may be imported if they are destined to be treated after arrival in New Zealand. The treatments (at 85°C and 40% RH for a minimum of 15 hours or irradiated at a dose of 25 KGy) must be carried out in a transitional facility approved for this purpose to render seeds non-viable. Irradiated seeds must not be used for human consumption. For import under this option, seeds must carry a phytosanitary certificate issued by the exporting NPPO stating that the consignment has been inspected and found to be free of any visually detectable live regulated pest.

(48) In the proposed new schedule, only treated *Pennisetum glaucum* and *P. clandestinum* seeds will be eligible for import and biosecurity clearance.

(49) At this stage and with the current information, we are not including options for:

a) Importing seeds for processing in New Zealand; or
b) Importing seeds for biosecurity clearance on arrival at the New Zealand border.

2.3.3 Rationale for the proposed change

(50) Currently, *Pennisetum glaucum* and *P. clandestinum* seeds can only be imported into New Zealand either for sowing (under the standard *Seeds for Sowing*) or research (under the standard *Research Samples (Excluding Animal Samples)*). Demand to import these seeds for consumption and feed is growing, and we need a pathway for these goods.

(51) Because there is no recent risk assessment for these seeds, MPI has only proposed import options that allow treated seeds (treated offshore or in a New Zealand facility) to be eligible for biosecurity clearance. The effectiveness of heat treatment and irradiation in mitigating biosecurity risks is fully explained in section 2.2.3.

(52) We do not expect the proposed changes to increase the chances of biosecurity risks being introduced into New Zealand environment through imported *Pennisetum glaucum* and *P. clandestinum* seeds.

2.3.4 Feasibility and consequences of the proposed change

(53) The proposed new schedule will allow importers to import Pennisetum glaucum and P. clandestinum seeds for human consumption or animal feed, with two import options. The requirements in these options have been successful in mitigating the pest risks associated with importing other seeds into New Zealand.

(54) All grain and seeds for consumption or feed already require a phytosanitary certificate. This requirement is the same as the requirements for other species. Therefore, it is feasible for importers to comply with the requirement for a phytosanitary certificate to accompany consignments of *Pennisetum glaucum* and *P. clandestinum* seeds.

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Appendix 1: Proposed changes to the standard

A- Proposed changes to the *Panicum* spp. schedule

2.14 *Panicum* spp. (millet)

(1) The regulated pest list for Panicum spp. grain can be found in Appendix 4.

(2) *Panicum* spp. grain may be imported under one of the following options:

2.14.1 Importation of grain/seeds devitalised in the country of origin (Option 1)

(1) *Panicum* spp. grain must be rendered non-viable prior to arrival in New Zealand, using one of the treatment options listed in Appendix 2.

(2) Following treatment, grain must be securely held to prevent contamination or re-infestation with regulated pests.

Documentation

(3) A phytosanitary certificate is required:

a) the following additional declaration must be included on the phytosanitary certificate:

i) "The *Panicum* spp. grain was heat-treated, and the consignment contains no viable seeds".

or

ii) "The *Panicum* spp. grain was irradiated at a dose of 25 KGy and the consignment contains no viable seeds."

Guidance

- Offshore treatment details can be recorded in the "Disinfestation and/or Disinfection Treatment" section of the phytosanitary certificate.

2.14.2 Importation of grain/seeds to be treated in New Zealand (Option 2)

(1) *Panicum* spp. grain must be treated in a transitional facility to render it non-viable, using one of the treatment options listed in Appendix 2.

Documentation

(2) A phytosanitary certificate is required.

Guidance

- For grain that are to be treated on arrival, the importer should, prior to import, ensure that the transitional facility can treat the consignment.

2.14.3 Importation of grain/seeds for processing in New Zealand (Option 3)

(1) *Panicum* spp. grain must be processed to render it non-viable in a transitional facility approved in accordance with the Standard for Transitional Facilities for General Uncleared Risk Goods.

(2) The transitional facility must be approved by MPI for holding and/or processing grain.

Documentation

(3) A sampling certificate and a seed analysis certificate are required; otherwise, the grain must be analysed upon arrival in New Zealand, as per Part 1.6.

(4) A phytosanitary certificate is required:

a) the following additional declaration must be included on the phytosanitary certificate:

i) "The *Panicum* spp. grain has been:

1) sourced from an area where *Anthracocystis destruens* (Syn: *Sorosporium manchuricum* and *Sporisorium destruens*), *Balansia claviceps*, *B. epichloe*, *B. oryzae-sativae*, *Cochliobolus pallescens* and *Ustilago crameri* ~~*Alternaria saparva*, *Aspergillus tamarii*, *Balansia andropogonis*, *B. claviceps*, *B. epichloe*, *B. henningsiana*, *B. oryzae sativae*, *B. pallida*, *B. sclerotica*, *B. strangulans*, *Bipolaris panici-miliacei*, *B. urochloae*, *Claviceps africana*, *C. fusiformis*, *C. maximensis*, *C. sorghi*, *Cochliobolus pallescens*, *C. setariae*, *Gloeocercospora sorghi*, *Melanomma panici-miliacei*, *Peronosclerospora graminicola*, *P. sorghi*, *Sorosporium afrum*, *S. cryptum*, *S. destruens*, *S. formosanum*, *S. harrismithense*, *S. manchuricum*, *S. panici*, *Sphacelotheca digitariae*, *S. veracruziana*, *Sporisorium cenchri*, *S. sorghi*, *Tilletia ayresii*, *T. barclayana*, *T. biharica*, *T. courtetiana*, *T. maclagani*, *T. narayanaraoana*, *T. tumefaciens*, *T. verrucosa*, *Ustilago crameri* and *U. heterogena*~~ are known not to occur/ not known to occur;

or

2) sourced from a crop that has been inspected during the growing season according to appropriate procedures and *Anthracocystis destruens* (Syn: *Sorosporium manchuricum* and *Sporisorium destruens*), *Balansia claviceps*, *B. epichloe*, *B. oryzae-sativae*, *Cochliobolus pallescens* and *Ustilago crameri* ~~*Alternaria saparva*, *Aspergillus tamarii*, *Balansia andropogonis*, *B. claviceps*, *B. epichloe*, *B. henningsiana*, *B. oryzae sativae*, *B. pallida*, *B. sclerotica*, *B. strangulans*, *Bipolaris panici-miliacei*, *B. urochloae*, *Claviceps africana*, *C. fusiformis*, *C. maximensis*, *C. sorghi*, *Cochliobolus pallescens*, *C. setariae*, *Gloeocercospora sorghi*, *Melanomma panici-miliacei*, *Peronosclerospora graminicola*, *P. sorghi*, *Sorosporium afrum*, *S. cryptum*, *S. destruens*, *S. formosanum*, *S. harrismithense*, *S. manchuricum*, *S. panici*, *Sphacelotheca digitariae*, *S. veracruziana*, *Sporisorium cenchri*, *S. sorghi*, *Tilletia ayresii*, *T. barclayana*, *T. biharica*, *T. courtetiana*, *T. maclagani*, *T. narayanaraoana*, *T. tumefaciens*, *T. verrucosa*, *Ustilago crameri* and *U. heterogena*~~ were not detected;

or

3) representatively sampled with a sample size of five times (5×) ISTA and in accordance with ISTA or AOSA guidelines/methodologies. The samples were tested using NPPO-approved testing methods ~~ISTA or AOSA guidelines/methodologies. The samples were tested at a NPPO approved diagnostic laboratory~~ and the test result was negative for ~~*Alternaria saparva*,~~ *Anthracocystis destruens* (Syn: *Sorosporium manchuricum* and *Sporisorium destruens*), *Balansia claviceps*, *B. epichloe*, *B. oryzae-sativae*, *Cochliobolus pallescens* and *Ustilago crameri* ~~*Aspergillus tamarii*, *Balansia andropogonis*, *B. claviceps*, *B. epichloe*, *B. henningsiana*, *B. oryzae sativae*, *B. pallida*, *B. sclerotica*, *B. strangulans*, *Bipolaris panici-miliacei*, *B. urochloae*, *Claviceps africana*, *C. fusiformis*, *C. maximensis*, *C. sorghi*, *Cochliobolus pallescens*, *C. setariae*, *Gloeocercospora sorghi*, *Melanomma panici-miliacei*, *Peronosclerospora graminicola*, *P. sorghi*, *Sorosporium afrum*, *S. cryptum*, *S. destruens*, *S. formosanum*, *S. harrismithense*, *S. manchuricum*, *S. panici*, *Sphacelotheca digitariae*, *S. veracruziana*, *Sporisorium cenchri*, *S. sorghi*, *Tilletia ayresii*, *T. barclayana*, *T. biharica*, *T. courtetiana*, *T. maclagani*, *T. narayanaraoana*, *T. tumefaciens*, *T. verrucosa*, *Ustilago crameri* and *U. heterogena*.~~"

If this declaration can not be included in the phytosanitary certificate, MPI will accept a separate lab test result endorsed by the NPPO of the exporting country.

and

ii) "The *Panicum* spp. grain:

1) was sourced from an area where *Aphelenchoides besseyi* is known not to occur/ not known to occur;

or

2) has undergone appropriate pest control activities that are effective against *Aphelenchoides besseyi*;

> **Guidance**
>
> - Importers may also apply to MPI to have consignments that have been representatively sampled by the exporting country's NPPO, tested at an MPI-approved diagnostic laboratory for the presence of *Anthracocystis destruens (Syn: Sorosporium manchuricum and Sporisorium destruens), Balansia claviceps, B. epichloe, B. oryzae-sativae, Cochliobolus pallescens and Ustilago crameri* ~~regulated pests listed above~~. The sample size must be five times (5×) ISTA or AOSA guidelines/ methodologies.

2.14.4 Importation of grain/seeds for biosecurity clearance on arrival at the New Zealand border (Option 4)

Documentation

(1) A sampling certificate and a seed analysis certificate are required; otherwise, the grain must be analysed upon arrival in New Zealand as per Part 1.6.

(2) A phytosanitary certificate is required:

a) the following additional declaration must be included on the phytosanitary certificate:

i) "The *Panicum* spp. grain has been:

1) inspected in accordance with appropriate official procedures and found to be free of any live, visually detectable regulated insects;

or

2) fumigated with an appropriate pesticide and subsequently found to be free of any live, visually detectable regulated insects;

and

ii) "The *Panicum* spp. grain has been:

1) sourced from an area where *Aphelenchoides besseyi* is known not to occur/ not known to occur;

or

2) fumigated with an appropriate pesticide and subsequently found to be free of live *Aphelenchoides besseyi*;

and

iii) "The *Panicum* spp. grain has been:

1) sourced from a "pest free area" where *Anthracocystis destruens (Syn: Sorosporium manchuricum and Sporisorium destruens), Balansia claviceps, B. epichloe, B. oryzae-sativae, Cochliobolus pallescens and Ustilago crameri* ~~*Alternaria saparva, Aspergillus tamarii, Balansia andropogonis, B. claviceps, B. epichloe, B. henningsiana, B. oryzae-sativae, B. pallida, B. sclerotica, B. strangulans, Bipolaris panici-miliacei, B. urochloae, Claviceps africana, C. fusiformis, C. maximensis, C. sorghi, Cochliobolus pallescens, C. setariae, Gloeocercospora sorghi, Melanomma*~~

panici miliacei, Peronosclerospora graminicola, P. sorghi, Sorosporium afrum, S. cryptum, S. destruens, S. formosanum, S. harrismithense, S. manchuricum, S. panici, Sphacelotheca digitariae, S. veracruziana, Sporisorium cenchri, S. sorghi, Tilletia ayresii, T. barclayana, T. biharica, T. courtetiana, T. maclagani, T. narayanaraoana, T. tumefaciens, T. verrucosa, Ustilago crameri and U. heterogena are known not to occur/ not known to occur;

or

2) sourced from a "pest free place of production" where Anthracocystis destruens (Syn: Sorosporium manchuricum and Sporisorium destruens), Balansia claviceps, B. epichloe, B. oryzae-sativae, Cochliobolus pallescens and Ustilago crameri Alternaria saparva, Aspergillus tamarii, Balansia andropogonis, B. claviceps, B. epichloe, B. henningsiana, B. oryzae sativae, B. pallida, B. sclerotica, B. strangulans, Bipolaris panici miliacei, B. urochloae, Claviceps africana, C. fusiformis, C. maximensis, C. sorghi, Cochliobolus pallescens, C. setariae, Gloeocercospora sorghi, Melanomma panici miliacei, Peronosclerospora graminicola, P. sorghi, Sorosporium afrum, S. cryptum, S. destruens, S. formosanum, S. harrismithense, S. manchuricum, S. panici, Sphacelotheca digitariae, S. veracruziana, Sporisorium cenchri, S. sorghi, Tilletia ayresii, T. barclayana, T. biharica, T. courtetiana, T. maclagani, T. narayanaraoana, T. tumefaciens, T. verrucosa, Ustilago crameri and U. heterogena are known not to occur/ not known to occur;

or

3) representatively sampled with a sample size of five times (5×) ISTA and in accordance with ISTA or AOSA guidelines/methodologies. The samples were tested using NPPO-approved testing methodsISTA or AOSA guidelines/methodologies. The samples were tested at a NPPO approved diagnostic laboratory and the test result was negative for Anthracocystis destruens (Syn: Sorosporium manchuricum and Sporisorium destruens), Balansia claviceps, B. epichloe, B. oryzae-sativae, Cochliobolus pallescens and Ustilago crameri Alternaria saparva, Aspergillus tamarii, Balansia andropogonis, B. claviceps, B. epichloe, B. henningsiana, B. oryzae sativae, B. pallida, B. sclerotica, B. strangulans, Bipolaris panici miliacei, B. urochloae, Claviceps africana, C. fusiformis, C. maximensis, C. sorghi, Cochliobolus pallescens, C. setariae, Gloeocercospora sorghi, Melanomma panici miliacei, Peronosclerospora graminicola, P. sorghi, Sorosporium afrum, S. cryptum, S. destruens, S. formosanum, S. harrismithense, S. manchuricum, S. panici, Sphacelotheca digitariae, S. veracruziana, Sporisorium cenchri, S. sorghi, Tilletia ayresii, T. barclayana, T. biharica, T. courtetiana, T. maclagani, T. narayanaraoana, T. tumefaciens, T. verrucosa, Ustilago crameri and U. heterogena."

If this declaration can not be included in the phytosanitary certificate, MPI will accept a separate lab test result endorsed by the NPPO of the exporting country.

or

4) (only for Peronosclerospora sorghi) commercially dried to 14% moisture content or less to kill fungal spores of Peronosclerospora sorghi."

and

iv) "The Panicum spp. grain was:

1) sourced from a "pest free area" where Panicum mosaic virus is known not to occur/ not known to occur;

or

2) sourced from a "pest free place of production" where Panicum mosaic virus is known not to occur/ not known to occur."

Guidance

- Importers may also apply to MPI to have consignments that have been representatively sampled by the exporting country's NPPO, tested at an MPI-approved diagnostic laboratory for the presence of *Anthracocystis destruens* (Syn: *Sorosporium manchuricum* and *Sporisorium destruens*), *Balansia claviceps*, *B. epichloe*, *B. oryzae-sativae*, *Cochliobolus pallescens* and *Ustilago crameri* ~~regulated pests listed above~~. The sample size must be five times (5×) ISTA or AOSA guidelines/ methodologies.
- Treatment details for regulated pests can be recorded in the "Disinfestation and/or Disinfection Treatment" section of the phytosanitary certificate.

Appendix 4: Pest list

***Panicum* spp. REGULATED PESTS**	
Insect *Palorus ratzeburgi* *Trogoderma inclusum* *Trogoderma ornatum*	*Peronosclerospora graminicola* *Peronosclerospora sorghi* *Sorosporium afrum* *Sorosporium cryptum* ~~*Sorosporium destruens*~~ *Sorosporium formosanum*

Nematode *Aphelenchoides besseyi* **Fungus** ~~*Alternaria saparva*~~ *Anthracocystis destruens* (Syn: *Sorosporium manchuricum* and *Sporisorium destruens*) ~~*Aspergillus tamarii*~~ ~~*Balansia andropogonis*~~ *Balansia claviceps* *Balansia epichloe* ~~*Balansia henningsiana*~~ *Balansia oryzae-sativae* ~~*Balansia pallida* (anamorph *Ephelis pallida*)~~ ~~*Balansia sclerotica*~~ ~~*Balansia strangulans*~~ ~~*Bipolaris panici-miliacei*~~ ~~*Bipolaris urochloae*~~ ~~*Claviceps africana*~~ ~~*Claviceps fusiformis*~~ ~~*Claviceps maximensis*~~ ~~*Claviceps sorghi* (anamorph *Sphacelia sorghi*)~~ *Cochliobolus pallescens* (anamorph *Curvularia pallescens*) ~~*Cochliobolus setariae* (anamorph *Bipolaris setariae*)~~ ~~*Gloeocercospora sorghi*~~ ~~*Melanomma panici-miliacei*~~	~~*Sorosporium harrismithense*~~ ~~*Sorosporium manchuricum*~~ ~~*Sorosporium panici*~~ ~~*Sphacelotheca digitariae*~~ ~~*Sphacelotheca veracruziana*~~ ~~*Sporisorium cenchri*~~ ~~*Sporisorium sorghi*~~ ~~*Tilletia ayresii*~~ ~~*Tilletia barclayana*~~ ~~*Tilletia biharica*~~ ~~*Tilletia courtetiana*~~ ~~*Tilletia maclagani*~~ ~~*Tilletia narayanaraoana*~~ ~~*Tilletia tumefaciens*~~ ~~*Tilletia verrucosa*~~ *Ustilago crameri* ~~*Ustilago heterogena*~~ ~~**Virus**~~ ~~*Panicum mosaic virus*~~

B- Proposed new schedule for *Brassica napus*

2.3 *Brassica napus* (canola, rapeseed, swedes)

(1) The regulated pest list for *Brassica napus* seeds can be found in Appendix 4.

(2) *Brassica napus* seeds may be imported under one of the following options:

2.3.1 Importation of grain/seeds devitalised in the country of origin (Option 1)

(1) *Brassica napus* seeds must be rendered non-viable prior to arrival in New Zealand, using one of the treatment options listed in Appendix 2.

(2) Following treatment, seeds must be securely held to prevent contamination or re-infestation with regulated pests.

Documentation

(3) A phytosanitary certificate is required.

a) The following additional declaration must be included on the phytosanitary certificate:

i) "The *Brassica napus* seeds were heat-treated, and the consignment contains no viable seeds";

or

ii) "The *Brassica napus* seeds were irradiated at a dose of 25 KGy and the consignment contains no viable seeds".

> **Guidance**
>
> - Offshore treatment details can be recorded in the "Disinfestation and/or Disinfection Treatment" section of the phytosanitary certificate.

2.3.2 Importation of grain/seeds to be treated in New Zealand (Option 2)

(1) *Brassica napus* seeds must be treated in a transitional facility to render them non-viable, using one of the treatment options listed in Appendix 2.

Documentation

(2) A phytosanitary certificate is required.

> **Guidance**
>
> - For seeds that are to be treated on arrival, the importer should, prior to import, ensure that the transitional facility can treat the consignment.

2.3.3 Importation of grain/seeds for processing in New Zealand (Option 3)

(1) *Brassica napus* seeds must be processed in a transitional facility approved in accordance with the Standard for Transitional Facilities for General Uncleared Risk Goods.

(2) The transitional facility must be approved by MPI for holding and/or processing seeds.

(3) *Brassica napus* seeds must only be used for the manufacture of food/feed products and any residue must be held and destroyed as directed by an Inspector.

Documentation

(4) A sampling certificate and a seed analysis certificate are required; otherwise, the seeds must be analysed upon arrival in New Zealand, as per Part 1.6.

(5) A phytosanitary certificate is required.

2.3.4 Importation of grain/seeds for biosecurity clearance on arrival at the New Zealand border (Option 4)

(1) *Brassica napus* seed is not eligible for importation for biosecurity clearance on arrival at the New Zealand border.

Appendix 4: Pest list

Brassica napus **REGULATED PESTS**	
Fungus *Alternaria ethzedia*	**Bacterium** *Xanthomonas campestris pv. aberrans* *Xanthomonas campestris pv. armoraciae* *Xanthomonas campestris pv. raphanin* **Virus** *Turnip yellow mosaic virus*

C- Proposed new schedule for *Pennisetum glaucum* and *P. clandestinum*

2.15 *Pennisetum glaucum* and *P. clandestinum* (green millet)

(3) *Pennisetum glaucum* and *P. clandestinum* seeds may be imported under one of the following options:

2.15.1 Importation of grain/seeds devitalised in the country of origin (Option 1)

(1) *Pennisetum glaucum* and *P. clandestinum* seeds must be rendered non-viable prior to arrival in New Zealand, using one of the treatment options listed in Appendix 2.

(2) Following treatment, seeds must be securely held to prevent contamination or re-infestation with regulated pests.

Documentation

(3) A phytosanitary certificate is required.

a) The following additional declaration must be included on the phytosanitary certificate:

i) "The *Pennisetum glaucum* and *P. clandestinum* seeds were heat-treated, and the consignment contains no viable seeds";

or

ii) "The *Pennisetum glaucum* and *P. clandestinum* seeds were irradiated at a dose of 25 KGy and the consignment contains no viable seeds".

> **Guidance**
> - Offshore treatment details can be recorded in the "Disinfestation and/or Disinfection Treatment" section of the phytosanitary certificate.

2.15.2 Importation of grain/seeds to be treated in New Zealand (Option 2)

(4) *Pennisetum glaucum* and *P. clandestinum* seeds must be treated in a transitional facility to render them non-viable, using one of the treatment options listed in Appendix 2.

Documentation

(5) A phytosanitary certificate is required.

> **Guidance**
> - For seeds that are to be treated on arrival, the importer should, prior to import, ensure that the transitional facility can treat the consignment.

2.15.3 Importation of grain/seeds for processing in New Zealand (Option 3)

(6) *Pennisetum glaucum* and *P. clandestinum* seeds are not eligible for importation for processing in a transitional facility

2.15.4 Importation of grain/seeds for biosecurity clearance on arrival at the New Zealand border (Option 4)

(7) *Pennisetum glaucum* and *P. clandestinum* seeds are not eligible for importation for biosecurity clearance on arrival at the New Zealand border.

Appendix 2: Technical advice

A- Technical advice: pests associated with *Panicum* spp. seeds

Status: FINAL
Activity: Scientific technical advice

Biosecurity New Zealand
Tiakitanga Pūtaiao Aotearoa

Technical advice on: Review to determine whether 45 regulated pests currently listed in the *Panicum* (L.) spp. (millet) (*Poaceae*) schedule, Section 2.14.4 of the Grain and Seeds for Consumption, Feed or Processing Import Health Standard 2021, are associated with *Panicum* seed.

Date: 24 September 2021

Name: [redacted]

Position: Adviser—Kaitohutohu, Plant Risk Analysis, Animal & Plant Health Directorate

Purpose of document

The purpose of this technical advice (TA) is to determine whether 45 regulated pests currently listed in the *Panicum* schedule (Section 2.14.4) of the Grain and Seeds for Consumption, Feed or Processing Import Health Standard, 2021 (GCFP.IHS) are associated with *Panicum* seed.

Background

The GCFP.IHS lists 48 pests associated with *Panicum* seed, whereas the Seeds for Sowing Import Health Standard, 2021, (155.02.05) lists only two quarantine pathogens (*Peronosclerospora sorghi*, and *Sclerospora graminicola*) and a pathogenic order (*Ustilaginales*) as regulated pests associated with *Panicum* spp. seed for sowing in Section 2.55. Therefore, the Plant Product Imports Team (PPIT) requested a review to determine whether 45 pests, consisting of 43 fungi, one nematode and one virus, currently listed in the *Panicum* spp. (millet) schedule of the GCFP.IHS, are associated with *Panicum* seed. As per the request, the TA excluded three regulated insect pests also listed. The intended outcome of the advice is to assist PPIT in ascertaining which of the pests require further assessment to decide if the current IHS measures are appropriate for the level of risk they may pose to Aotearoa New Zealand.

Summary of advice

Of the 45 pest species listed in the GCFP.IHS associated with *Panicum* seed, the review has determined that:

- four species are associated with *Panicum* seed;
- forty-one species are not associated with *Panicum* seed;
- four of the pests are present in Aotearoa New Zealand.

Pests were classified as having an association with *Panicum* seed if evidence indicated that the species are seed-borne pathogens of *Panicum*. The evidence and associated uncertainty (defined by DEFRA 2011; Appendix 2) for the below conclusions are presented in Table 1. When interpreting these conclusions, it is important to note the scarcity of research relating to the seed-borne status of pests known to be associated with *Panicum*. A detailed outline of how research was gathered, including which databases were used, can be found in Supporting Information (page seven).

Table 1: Review of whether 45 listed pests associated with the Grain and Seeds for Consumption, Feed or Processing Import Health Standard, 2021 *Panicum* spp. (millet) import pathway Section 2.14.4. are associated with the *Panicum* seed.

Organism Type	Organism scientific name	Present in New Zealand (Y/N)	*Panicum* seed-borne × (Y/N)	*Panicum* seed-transmitted¥ (Y/N)	Additional information
Virus	*Panicum mosaic virus*	N	No evidence found.	N*	Major host *Panicum virgatum* (EPPO 2021); unlikely seed-transmitted (Sill and Desai 1960 (*P. virgatum* seed from naturally infected parent plants failed to display disease symptoms post germination)).
Nematode	*Aphelenchoides besseyi*		Y**	Y**	Seed-borne and seed-transmitted on *Panicum maximum* (CABI 2021; Garcia et al. 2000: isolated from naturally infected *P. maximum* seeds via the Blotter method; successfully used heat treatment to eradicate *A. besseyi* from infected seed); seed-transmitted in rice (Pei et al. 2012; CABI 2021); *P. miliaceum* is listed as a host (EPPO 2021).
Fungi	*Alternaria saparva*		Y*	No evidence found.	Seed-borne on *Panicum maximum* (Garcia et al. 2000: isolated *A. saparva* from naturally infected *P. maximum* seeds using the Blotter method).
	Aspergillus tamarii	Y	No evidence found.		No evidence of association with *Panicum*. Seed-borne on *Paspalum scrobiculatum* (Antony et al. 2003), *Arachis hypogaea* (Ibiam and Egwu, 2011) and cotton (Cyberliber 2021).
	Balansia andropogonis	N			No evidence of association with *Panicum*. Associated with *Andropogon aciculatus* flowers (Index Fungorum 2021).
	B. claviceps				Associated with *Panicum ghiesbreghtii* and *P. palmifolium* inflorescence (Reedy et al. 2018: *B. claviceps* identified from herbarium samples via morphological studies and DNA sequencing); Isolated from *P. maximum* (Lenne 1990); and *Setaria* and *Pennisetum* spicules (Index Fungorum 2021).
	B. epichloe				No evidence of association with *Panicum*. Associated with *Chasmanthium laxum* (Cyberliber 2021); *Cynodon dactylon*; *Sporobolus poiretii*; *Andropogon* spp.; *Eragrostis* spp. (Cyberliber 2021), and *Eragrostis capillaris* leaves (Cyberliber 2021).
	B. henningsiana				No evidence of association with *Panicum*. Associated with *Andropogon virginicus* (Cyberliber 2021).

Organism Type	Organism scientific name	Present in New Zealand (Y/N)	*Panicum* seed-borne × (Y/N)	*Panicum* seed-transmitted¥ (Y/N)	Additional information
Fungi	*B. oryzae-sativae*	N	No evidence found.	No evidence found.	No evidence of association with *Panicum*. Associated with *Oryza sativa* inflorescence (Index Fungorum 2021).
	B. pallida				No evidence of association with *Panicum*. Associated with rice inflorescence and leaves (Cyberliber 2021).
	B. sclerotica		.		No evidence of association with *Panicum*. Synonym of *Nigrocornus scleroticus* (preferred name.) (CABI 2021).
	B. strangulans				Associated with *Panicum hians* leaf nodes (Cyberliber 2021: naturally infected *P. hians* collected, transplanted, and analysed via culture).
	Bipolaris panici-miliacei				No additional information found.
	B. urochloae	Y	Y*		Seed-borne on *Panicum maximum* (Garcia et al. 2000: naturally infected *P. maximum* seeds analysed via the Blotter method).
	Claviceps africana	N	No evidence found.		No evidence of association with *Panicum*. Seed-borne on *Sorghum bicolor* (Bhuiyon et al. 2002; Cyberliber 2021).
	C. fusiformis				No evidence of association with *Panicum*. Seed-borne on *Pennisetum glaucum* (Zida et al. 2008) and *P. typhoides* ovaries (Index Fungorum 2021).
	C. maximensis				Associated with *Panicum maximum* (Index Fungorum 2021) ovaries (Cyberliber 2021: artificially infected *P. maximum* inflorescence examined via electron microscope).
	C. sorghi				No evidence of association with *Panicum*. Widely associated with sorghum; associated with *Sphacelia sorghi* sclerotia (Index Fungorum 2021).
	Cochliobolus pallescens				No additional information found.
	Cochliobolus setariae				No additional information found.

Organism Type	Organism scientific name	Present in New Zealand (Y/N)	*Panicum* seed-borne × (Y/N)	*Panicum* seed-transmitted¥ (Y/N)	Additional information
Fungi	*Gloeocercospora sorghi*	N	No evidence found.	No evidence found.	Synonym of *Microdochium sorghi* (preferred name) (NZFUNGI 2021). No additional information found.
	Melanomma panici-miliacei				Associated with *Panicum miliaceum*, no further detail provided (Index Fungorum 2021).
	Peronosclerospora graminicola				No evidence of association with *Panicum*. Synonym of *Sclerospora graminicola* (preferred name) (ONZPR 2021); seed-borne on *Pennisetum glaucum* (Rao and Sagwan, 2013); associated with *P. typhoideum* (Cyberliber 2021).
	Peronosclerospora sorghi				No evidence of association with *Panicum*. Associated with *Pennisetum glaucum* (Thakur 1999; Cyberliber 2021).
	Sorosporium afrum				Synonym of *Anthracocystis hodsonii* (MYCOBANK 2021); associated with *Panicum bicolor* (Vanky 2005), *P. maximum* (Lenne 1990), *P. laevifolium* (Zundel 1938) inflorescence (Cyberliber 2021: sori observed 'destroying' the whole inflorescence), *P. capillare, P. dichotomiflorum, P. subalbidum, P. schinzii, P. virgatum* (Cyberliber 2021).
	Sorosporium cryptum				Synonym of *Anthracocystis crypta* (preferred name) (NZFUNGI 2021); associated with *Panicum decompositum; P. queenslandicum* (Lenne 1990); *P. miliaceum* (Vanky 2005), *P. bicolor* and *P. effusum* (McAlpine 1910), and inflorescence (Cyberliber 2021).
	Sporisorium destruens	Y	Y*	Y*	Synonym of *Anthracocystis destruens* (preferred name) (NZFUNGI 2021); seed-borne and seed transmitted on *Panicum miliaceum* (Zhou et al. 2016: *P. miliaceum* plants, grown from naturally infected ears, analysed via RAPD-PCR amplification); Cyberliber 2021).
	Sorosporium formosanum	N	No evidence found.	No evidence found.	Synonym of *Anthracocystis formosana* (preferred name) (NZFUNGI 2021); associated with *Panicum repens* (Ingold 1997: spores cultured from naturally infected *P. repens*); Vanky 2005), and *Tricholaena teneriffae* (synonym: *P. teneriffae*) (Lenne 1990).
	Sorosporium harrismithense				Associated with *Panicum* (Cyberliber 2021) inflorescence (Cyberliber 2021), and *Andropogon* flowers (Index Fungorum 2021).

Organism Type	Organism scientific name	Present in New Zealand (Y/N)	*Panicum* seed-borne × (Y/N)	*Panicum* seed-transmitted¥ (Y/N)	Additional information
Fungi	*Sorosporium manchuricum*	Y	No evidence found.	No evidence found.	Synonym of *Anthracocystis destruens* (preferred name) (Mycobank 2021); associated with *Panicum miliaceum* (Cyberliber 2021: sori observed 'destroying' inflorescence).
	Sorosporium panici	N			No evidence of association with *Panicum*. Synonym of *Anthracocystis formosana* (preferred name) (NZFUNGI 2021). See *Sorosporium formosanum*.
	Sphacelotheca digitariae				No evidence of association with *Panicum*. Associated with *Digitaria horizontalis* (Cyberliber 2021).
	Sphacelotheca veracruziana				Associated with *Panicum*, no further detail provided (Cyberliber 2021), and *P. viscidellum* (Index Fungorum 2021).
	Sporisorium cenchri				Synonym of *Anthracocystis cenchri* (preferred name) (NZFUNGI 2021); associated with *Panicum capillare, P. dichotomiflorum* (Cyberliber 2021) and *P. miliaceum* (Lenne 1990) inflorescence (Cyberliber 2021); seed-borne on *Cenchrus* spp. (Savchenko et al. 2010; Cyberlibre 2021).
	Sporisorium sorghi				No evidence of association with *Panicum*. Seed-borne on sorghum (Nzioki et al. 2001; Cyberliber 2021).
	Tilletia ayresii				Synonym of *Conidiosporomyces ayresii* (NZFUNGI 2021); associated with *Panicum hians* (Lenne 1990); *Panicum* and *P. maximum* inflorescence (Zundel 1938; Lenne 1990; Borges and Camacaro 2011).
	T. barclayana				Associated with *Panicum*, *P. hians* (Cyberliber 2021), *P. virgatum* (Cyberliber 2021), *Pennisetum triflorum* (Cyberlibre 2021) and rice (Babadoost and Mathre, 1998; Pimentel et al. 1998).
	T. biharica				Associated with *Panicum trypheron* (Lenne 1990) and *Panicum* ovaries (Thirumalachar and Pavgi 1953; Vanky 2005; Cyberliber 2021).
	T. courtetiana				Associated with *Panicum*, no further details provided (Zundel 1938), and *P. subalbabidum* on ovaries (Vanky 2005).

Organism Type	Organism scientific name	Present in New Zealand (Y/N)	*Panicum* seed-borne × (Y/N)	*Panicum* seed-transmitted¥ (Y/N)	Additional information
Fungi	*T. maclagani*	N	No evidence found.	No evidence found.	Associated with *Panicum virgatum* (Gravert et al. 2000: naturally infected flowers failed to produce seeds, which were 'replaced' by fungal spores); Lenne 1990; Vanky 2005) ovaries and panicles (Helin 1961: naturally infected).
	T. narayanaraoana				Associated with *Panicum*, *P. hirticaule* (Lenne 1990), *P. typheron* (Thirumalachar and Pavgi 1953); *P. trypheron* ovaries (Cyberliber 2021).
	T. tumefaciens				Associated with *Panicum antidotale* axillary buds (Lenne 1990; Vanky 2005) and leaves (Index Fungorum 2021).
	T. verrucosa				Associated with *Panicum coloratum* ovaries (Vanky 2005) and *P. miliaceum* (Lenne 1990); seed-borne on *Ehrharta calycina* (Talbot 1958).
	Ustilago crameri				Associated with *Panicum miliaceum* (Lenne 1990), 'millet' (Bin and Zhaoju 2009); *Pennisetum* (Kumar 2011) and *Setaria italica* inflorescence spikelets (Cyberliber 2021).
	U. heterogena				Associated with *Panicum dichotomifolium* stems, leaves and inflorescence; *P. virgatum* (Lenne 1990; Cyberliber 2021); seed-borne on *Leptochloa virgata* (Hennings 1904; Cyberliber 2021).

* High uncertainty due to scarce evidence; ** Low uncertainty due to strong evidence in multiple references; × Seed-borne defined as a pathogen infecting a seed externally or internally; ¥ Seed transmitted defined as a seed-borne pathogen that vertically (seed to seedling) infects the host plant. Evidence uncertainty defined using DEFRA 2011; Appendix 2.

Supporting information

Methodology

Firstly, the following databases were used to confirm whether an organism is present or absent in New Zealand:

- NZOR
- NZFUNGI
- ONZPR
- Plant Protection Information Network
- Veerakone et al. (2015) for viruses

Secondly, database searches, which were done using scientific and common names, synonyms, anamorphs and teleomorphs where applicable (Appendix 1), were completed in the following:

- BioOne Complete
- CABI
- Common Access to Biological Resources and Information
- Culture Collections Information Worldwide
- Encyclopaedia Of Life (Smithsonian natural history museum)
- European and Mediterranean Plant Protection Organization Global Database
- Global Biodiversity Information Facility
- Google
- Google Scholar
- ICTV Virus Taxonomy Profiles
- Index Fungorum
- Mycobank Database
- Cyberliber, An Electronic Library of Mycology (Due to the complexity of the search engine, direct links to references have been provided).
- Landcare Research New Zealand Fungi (NZFUNGI)
- New Zealand Organisms Register (NZOR)
- Official New Zealand Pest Register (ONZPR)
- Pest Risk Analysis Tracker
- Systematics Collections Data, Landcare Research
- US Department of Agriculture Animal and Plant Health Inspection Service
- Westerdijk Fungal Biodiversity Institute
- Veerakone et al. 2015

Thirdly, when searching for evidence of association with *Panicum* spp., both '*Panicum*' and 'millet' terms were used. However, only sources linked to 'millet' that specifically focused on '*Panicum*' spp. were included as sources.

Lastly, to ensure transparency and ease of access relating to evidence used in this advice, further detail has been provided within Table 1 specifically relating to *Panicum* studies.

Additional information relating to the ergot (*Balansia* and *Claviceps*) life-cycle

The life-cycle of ergot fungi begins with wind-borne ascospores dispersing to suitable hosts, typically attaching and germinating on the pistil of flowers (Tenberge 2006). According to Parbery (1996), this attachment initiates a predictable pattern of pathogenesis, with infection confined to host ovaries. Stroma grow within the ovary, produce masses of spores contained within honeydew, which enables further dispersal via rain splash, head-to-head contact between adjacent plants, or by insects.

Additional information relating to the smut (*Sorosporium, Sporisorium and Tilletia*) life-cycle

According to van der Linde and Gore (2021), smuts are parasitic pathogens with a narrow host range which can be divided into three infection regimes: fungi that infect 1) locally, or organ-specific, with teliospore synthesis at the original site of infection; 2) systemically on several host tissues, with teliospore synthesis away from the original site of infection; 3) both locally and systemically. Typical for smuts, those that infect ovaries replace seeds with teliospores.

Time: 160 hrs

Reviewed by: [redacted]

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Signoff:

Version number	Approved for internal use, by:	Approval date:
V 1.0	Oluwashola Olaniyan Acting Manager, Plant Risk Analysis	24/09/2021
Comments:	Approval for external release is required, as the advice will be used for consultation with external stakeholders	

Version number	Approved for external release, by:	Approval date:
V 1.0	Enrico Perotti	28/09/2021
Comments:		

Appendix 1: Organism type, scientific name and authority, synonym, anamorph and telemorph of 45 listed pests associated with the Grain and Seeds for Consumption, Feed or Processing Import Health Standard, 2021 *Panicum* spp. (millet) seed pathway Section 2.14.4. are associated with the commodity and import pathway. As per the Plant Product Imports Team request, the review excluded three insect pests specified in Section 2.14.4.

Organism Type	Scientific name and authority	Synonym/anamorph/telemorph	Common name
Virus	*Panicovirus panicum mosaic virus* Sill and Picket (1957)	Panicum mosaic panicovirus; *Panicum mosaic sobemovirus* [type strain]; St Augustine decline virus	Decline of St Augustine grass; PMV; St Augustine decline virus; St Augustine grass decline virus
Nematode	*Aphelenchoides besseyi* Christie 1942	*Aphelenchoides oryzae* Yokoo 1948	Rice leaf nematode; rice white-tip nematode; strawberry crimp disease nematode; white-tip nematode.
Fungi	*Alternaria saparva* (Subram.) Deighton (1969)	*Prathoda saparva* Subram. (1956)	NA
	Aspergillus tamarii Kita (1913) (stat. anam.) (preferred)	*Aspergillus flavofurcatus* Bat. & H. Maia (1955) (stat. anam.); *Aspergillus indicus* B.S. Mehrotra & Agnihotri (1963) [1962] (stat. anam.); *Aspergillus terricola* É.J. Marchal (1893) (stat. anam.); *Aspergillus terricola var. indicus* (B.S. Mehrotra & Agnihotri) Raper & Fennell (1965) (stat. anam.)	Rot.
	Balansia andropogonis Syd., P.Syd. & E.J.Butler (1911)	NA	NA
	B. claviceps Speg. (1885)	*Ephelis mexicana*	
	B. epichloe (Weese) Diehl (1950)	*Balansia kunzei* Morgan-Jones & R.A.Phelps (1995); *Botryosphaeria epichloe* Kunze; *Botryosphaeria epichloe* Kunze ex Sacc.(1895); *Dothichloe epichloe* Weese (1919); *Dothidea atramentaria* Berk. & M.A.Curtis (1876); *Dothidea limitata* Diehl (1939); *Sphaeria epichloe* Kunze (1828)	
	B. henningsiana (Möller) Diehl (1950)	*Ophiodothis henningsiana* Möller (1901)	NA
	B. oryzae-sativae Hashioka (1971)	*Balansia oryzae* (Syd.) Naras. & Thirum. (1943); *Ephelis oryzae* Syd. (1914); *Ephelis pallida* Pat. (1897) (stat. anam.)	Udbatta disease
	B. pallida G.Winter (1892)	*Claviceps pallida* (G.Winter) Henn. (1899); *Ephelis pallida* Pat. (1897) (stat. anam.)	NA
	B. sclerotica (Pat.) Höhn. (1911) Synonym	*Cordyceps strangulans* Mont.(1856); *Epichloe strangulans* (Mont.) Sacc.(1878)	
	B. strangulans (Mont.) Diehl (1950)	*Epichloe sclerotica* Pat. (1890); *Nigrocornus scleroticus* (Pat.) Ryley (2003) (preferred)	
	Bipolaris panici-miliacei (*Bipolaris shoemaker* (stat. anam.))	*Bipolaris shoemaker* (1959) (stat. anam); *Drechslera panici-miliacei* (Y.Nisik.) Subram. & B.L.Jain (1966); *Helminthosporium panici-miliacei* Y.Nisik.(1929)	Leaf blight

Organism Type	Scientific name and authority	Synonym/anamorph/telemorph	Common name
Fungi	*Bipolaris urochloae* (V.A. Putterill) Shoemaker (1959)	*Drechslera urochloae* (V.A.Putterill) Subram. & B.L.Jain (1966); *Helminthosporium urochloae* V.A.Putterill (1954)	Bipolaris flower speck
	Claviceps africana Freder., Mantle & De Milliano (1991)	NA	Ergot; ergot of sorghum; sugary disease of sorghum
	C. fusiformis	*Claviceps fusiformis* Loveless (1967)	Ergot of grasses; ergot of millet; pearl millet ergot
	C. maximensis T.Theis (1952)	NA	Ergot
	C. sorghi B.G.P.Kulk., Seshadri & Hegde (1976)	*Sphacelia sorghi* McRae (1917) (stat. anam.)	Ergot of sorghum; sorphum ergot; sugary disease of sorghum
	Cochliobolus pallescens (Tsuda & Ueyama) Sivan. (1987)	*Curvularia leonensis* M.B. Ellis (1966) (stat. anam.); *Curvularia pallescens* Boedijn (1933) (stat. anam.); *Pseudocochliobolus pallescens* Tsuda & Ueyama (1983)	Leaf spot of maize; storage rot of groundnut
	Cochliobolus setariae (S.Ito & Kurib.) Drechsler ex Dastur (1942)	*Bipolaris setariae (Sawada)* Shoemaker (1959); *Cochliobolus setariae (S.Ito & Kurib.) Drechsler (1942); Drechslera setariae* (Shoemaker) Subram. & B.L.Jain (1966); *Helminthosporium setariae* Lind (1913); *Helminthosporium setariae* Sawada (1919); *Ophiobolus setariae* S.Ito & Kurib. (1930)	Blight of millet; leaf blight; leaf spot of millet.
	Gloeocercospora sorghi D.C. Bain & Edgerton ex Deighton (1971) (stat. anam.)	*Microdochium sorghi* (D.C. Bain & Edgerton ex Deighton) U. Braun (1995) (preferred name).	Copper spot of turf; zonate leaf spot of maize; zonate leaf spot of sorghum.
	Melanomma panici-miliacei Murashk. (1938)	NA	NA
	Peronosclerospora graminicola (Sacc.) Sacc.(1882) Synonym	***Sclerospora graminicola* (Sacc.) J.Schröt.(1886) (preferred)**; *Peronospora setariae* Pass. (1879); *Protomyces graminicola* Sacc. (1876); *Sclerospora graminicola var. setariae-italicae* Traverso (1982); *Sclerospora setariae-italicae* (Traverso) Cif. & Sousa da Câmara (1963); *Ustilago urbani* Magnus (2021)	Graminicola downy mildew; green ear disease.
	Peronosclerospora sorghi (W. Weston & Uppal) C.G. Shaw (1978)	*Sclerospora andropogonis-sorghi* (Kulk.) Mundk. (1951); *Sclerospora graminicola var. andropogonis-sorghi* Kulk. (1913); *Sclerospora sorghi* W.Weston & Uppal (1913); *Sorosporium andropogonis-sorghi* S.Ito (1935)	Sorghum downy mildew.

Organism Type	Scientific name and authority	Synonym/anamorph/telemorph	Common name
Fungi	*Sorosporium afrum* Sydow 1935	*Anthracocystis hodsonii* (Zundel) McTaggart & R.G. Shivas (2012) (pref); *Sclerospora andropogonis-sorghi* (Kulk.) Mundk. (1951); *Sclerospora graminicola var. andropogonis-sorghi* Kulk. (1913); *Sclerospora sorghi* W.Weston & Uppal (1913); *Sorosporium andropogonis-sorghi* S.Ito (1935)	Smut.
	Sorosporium cryptum McAlpine 1910	*Anthracocystis crypta* McTaggart & Shivas 2012 (preferred name)	
	~~*Sorosporium*~~ *Sporisorium destruens* (Schlechtendal) Vanky 1985	*Anthracocystis destruens* Brefeld 1912/ *Sorosporium manchuricum* S.Ito 1935/ *Sphacelotheca manchurica* (S.Ito) Wang 1962	
	Sorosporium formosanum Sawada 1928	*Anthracocystis formosana* (Sawada) McTaggart & Shivas 2012 / *Ustilago formosana* Sawada 1922 / *Sporisorium formosanum* (Sawada) Vanky 1985/ *Sorosporium panici* E.Mackinnon 1913	
	Sorosporium harrismithense Zundel 1930	*Anthracocystis hodsonii* McTaggart & Shivas 2012/ *Sporisorium hodsonii* (Zundel)Vanky 2005/ *Sorosporium versatilis* (Sydow & P. Sydow) Zundel 1938/ *Sorosporium afrum* Sydow 1935	
	Sorosporium manchuricum S.Ito 1935	*Anthracocystis destruens* Brefeld 1912/ *Sporisorium destruens* (Schlechtendal) Vanky 1985/ *Sphacelotheca manchurica* (S.Ito) Wang 1962	
	Sorosporium panici E.Mackinnon 1913	*Sorosporium panici var. kinshaasense* Beeli 1923; *Sorosporium panici-miliacei* Takah 1902/*Anthracocystis formosana* (Sawada) McTaggart & Shivas 2012/ *Sorosporium formosanum* Sawada 1928	
	Sphacelotheca digitariae Clinton 1939	*Uredo digitariae* Kunze 1830	
	Sphacelotheca veracruziana Zundel & Dunlap 1939	*Sporisorium veracruzianum* (Zundel & Dunlap) M. Piepenbr 1995	Smut.
	Sporisorium cenchri (Lagerh) Vanky, 1985	*Anthracocystis cenchri* McTaggart & Shivas 2012 (preferred name) / *Sporisorium cenchr-elymoidis* Vanky & Shivas 2002/ *Ustilago cenchri* Lagerh 1895/ *Sorosporium texanum* Zundel 1944/ *Sorosporium chardoninum* Zundel 1942/ *Sporisorium cenchri (Bref.) Zundel 1938*	
	Sporisorium sorghi Ehrenb. Ex Link 1925	*Sporisorium pseudosorghi* Vanky, Shivas & Athip 2006	Kernel smut.

Organism Type	Scientific name and authority	Synonym/anamorph/telemorph	Common name
Fungi	*Tilletia ayresii* Berk 1899	*Conidiosporomyces* ayresii (Berk.) Vanky & R. Bauer 1992	Bunt.
	Tilletia barclayana (Brefeld) Saccardo & Sydow 1899	*Neovossia barclayana* (Brefeld 1895)/ *Tilletia pennisetina* Sydow 1929/ *Neovossia macrospora* Petrak 1947	Bunt of rice.
	Tilletia biharica Thirumalachar & Pavgi 1953	NA	Smut.
	Tilletia courtetiana Hariot & Patouillard 1909		
	Tilletia maclagani (Berkeley) Clinton 1902	*Ustilago maclagani* Tilletia maclagani 1874	
	Tilletia narayanaraoana Mundkur & Thirumalachar 1951	NA	
	Tilletia tumefaciens Sydow & P. Sydow 1912		
	Tilletia verrucosa Cook & Massee 1888		
	Ustilago crameri Körnicke 1874		Head smut of millet.
	Ustilago heterogena Hennings 1904		Smut.

Appendix 2: Evidence uncertainty ratings as defined by DEFRA (2011) Department for Environment, Food and Rural Affairs: Guidelines for Environmental Risk Assessment and Management - Green Leaves III. Prepared by Defra and the Collaborative Centre of Excellence in Understanding and Managing Natural and Environmental Risks, Cranfield University, November 2011.

High	• Scarce or no data available; evidence provided in unpublished reports of unknown authenticity; or • Few observations and personal communications; and/or • Authors' or experts' conclusions vary considerably
Moderate	• Some or only incomplete data available; evidence provided in small number of references; authors' or experts' conclusion vary; or • Limited evidence from field/lab observations; or • Solid and complete data available from other species that can be extrapolated to the species being considered
Low	• Solid and complete data available; strong evidence in multiple references with most authors coming to the same conclusions; or • Considerable and consistent experience from field observations

B- Technical advice: pests associated with *Brassica napus* seeds

Status: Version 1.0
Activity: Scientific technical advice

Biosecurity New Zealand
Tiakitanga Pūtaiao Aotearoa

Technical advice on: Potential hazard list of seed-borne and seed-transmitted pathogens associated with *Brassica napus* L. (oilseed rape/canola) and brief notes on their biology/lifecycles.

Date: 16 December 2021

Name: [redacted]

Position: Adviser - Plant Risk Analysis te Nikau, Animal and Plant Heath Directorate

Purpose of document

The purpose of this technical advice is to identify pest-pathogens potentially associated with *Brassica napus* (oilseed rape/canola), confirm whether they are seed-borne/seed-transmitted, and provide a brief description of their biology/lifecycles.

Background

The Plant Product Imports Team (PPIT) have requested a list of seed-borne/seed-transmitted pathogens potentially associated with *B. napus*, not considering specific requirements for seed for processing pathway. The list of potential hazards may then be further assessed to determine the level of risk they pose to New Zealand on the *B. napus* seed for consumption, feed, or processing pathway.

Summary of advice

Twenty pathogens have been identified as seed-borne or seed-transmitted in *B. napus* (Table 1).

- The 24 pathogens identified include 17 species of fungi, 1 bacteria, 1 oomycete, 1 protozoan and 1 virus. The bacteria species, *Xanthomonas campestris* includes four pathovars.
    - Of the 17 species of fungi, 15 are present in New Zealand.
    - Only one out of the four *Xanthomonas campestris* pathovars was present in New Zealand
    - The Oomycete, *Albugo candida* is present in New Zealand but some strains are regulated.
    - The protozoan, *Plasmodiophora brassicae* is present in New Zealand
    - The virus, Turnip yellow mosaic virus (TYMV), has not been reported in New Zealand.

Ministry for Primary Industries
Manatū Ahu Matua

Scientific and technical advice - Brassica napus seed-borne pathogens
page: 1 of 18

Table 1: Seed-borne/seed-transmitted pathogens of Brassica napus and brief notes about their biology/life cycle.

Organism type	Scientific name	Is it in NZ? Y/N	Seed-borne	Seed-transmitted	Notes on Biology/Life cycle
Oomycete	*Albugo candida*	Y	Y	No evidence found	Survey reports by (Petrie 1975) and Barbetti (1981) revealed that *A. candida* (Syn *A. cruciferarum*) is seed-borne on *B. napus*. Oospores carried on seed or in soil produce zoospores which can penetrate the hosts leaves/cotyledons and the pathogen continues to develop until its sporangia are released to be dispersed by wind or water until they settle on seed or soil (Saharan and Verma 1992).
Fungus	*Alternaria alternata*	Y	Y	No evidence found	*A. alternata* was among the common seed-borne pathogens observed in harvested varieties of *B. napus* grown in large experimental plots (Remlein-Starosta et al. 2015). The pathogen was also common in *B. napus* harvested from the field (Alpaslan and Ozer 2017) and in laboratory samples (Rude et al. 1999). The conidia of this fungus are often airborne and can be transported on seed when they settle there (Chung 2012).
	Alternaria brassicae	Y	Y		*A. brassicae* was among the common seed-borne pathogens observed in harvested varieties of *B. napus* grown in large experimental plots (Remlein-Starosta et al. 2015). The pathogen was also common in *B. napus* harvested from the field (Alpaslan and Ozer 2017) and in laboratory samples (Rude et al. 1999). The conidia are often airborne or dispersed by water splashes and can be transported on seed when they settle there (Kumar et al. 2014).
	Alternaria brassicicola	Y	Y		*A. brassicicola* was observed in harvested varieties of *B. napus* grown in large field experimental plots (Remlein-Starosta et al. 2015). Dormant mycelium or conidia can survive in or out of the seed coat until seed is sown (Kumar et al. 2014)
	Alternaria ethzedia	N	Y		*A. ethzedia* was observed among the seed-borne pathogens of *B. napus* observed in harvested samples from the field (Alpaslan and Ozer 2017). Information about this pathogen is sparse but like other *Alternaria* species, the conidia of this pathogen may be air-borne or water-borne and may settle on seed (Canola encyclopedia 2021)
	Alternaria infectoria	Y	Y		*A. infectoria* was observed among the seed-borne pathogens of *B. napus* observed in harvested samples from the field (Alpaslan and Ozer 2017). Information about this pathogen is sparse but like other *Alternaria* species, the conidia of this pathogen may be air-borne or water-borne and may settle on seed (Canola encyclopedia 2021)

Organism type	Scientific name	Is it in NZ? Y/N	Seed-borne	Seed-transmitted	Notes on Biology/Life cycle
Fungus	*Alternaria raphani*	Y	Y	No evidence found	Laboratory examination of *B. napus* seeds by Rude et al. (1999) confirmed that *A. raphani* is seed-borne but at a low infection rate (~ 2 % of seed samples). Conidia are often airborne and can settle on seed when there are lesions on the pods (Kumar et al. 2014; Canola encyclopedia 2021)
	Arthrinium arundinis	Y	Y		Specific details about the biology/life cycle of *A. arudinis* is scarce but (Minter 1985) and Webster (1966) reported that the conidia of *Arthrinium* species actively sever themselves from their conidiophores. Like other *Arthrinium* species, the conidia may be air-borne, water-borne or soil-borne (Agut and Calvo 2004; Senanayake 2020) which indicates that the spores may settle on seed. In addition, Ellis et al. 1951 reported that the conidia of *Arthrinium* species are also transported by insects and molluscs.
	Botrytis cinerea	Y	Y		Examination of *B. napus* seeds collected from different parts of Germany revealed that the pathogen is seed-borne at low levels ranging from 0.6% to 1.3% (Heppner and Heitefuss 1995). Gaetan et al. (1995) also asserts that *B. cinerea* is a pathogen of *B. napus*. Scerotia which develop from dying host tissues are the usual propagules of the pathogen but conidia produced from the scelorotia are the primary inoculum (Williamson et al 2007).
	Mycosphaerella brassicicola	Y	Y		Vanterpool (1960) isolated *M. brassicicola* from diseased seeds and plant debris of *B. napus* (*Syn B campestris var annua*). Ascospores are the infective stages but spores from the conidia are often internally or externally seedborne (Van den Ende 1998). Infected debris or pseudothecia in the soil allows the cycle to persist (Van den Ende 1998).
	Plasmodiophora brassicae	Y	Y	Y	Laboratory experiments by Rennie et al. (2011) showed that seed inoculation with resting spores > 10³ per seed show disease symptoms. Using two *B. napus* varieties from diseased crops in a garden experiment, Warne (1943) found a higher infection rate (53%, n=40 and 16%, n=45) in plants from untreated seeds compared to surface sterilised seeds (41%,n=46 and 2%, n=63) indicating seed transmission. However, Kageyama and Asano (2009) reported that resting spores may survive on seeds but are mostly transmitted by soil or water. The infective stage is the primary zoospores produced by the resting spores in moist soil (Kageyama and Asano 2009).
	Plenodomus biglobosus	Y	Y	Y	*P. biglobosus* (Syn *Leptosphaeria biglobosa*) was among the seed-borne pathogens observed in harvested varieties of *B. napus* which grown in large experimental plots (Remlein-Starosta et al. 2015). From 3 samples (100 seeds each) containing the pathogen, the percentage of infected seeds ranged between 6% and 16% (Remlein-Starosta et al. 2015). Dilantha et al (2016) examined *B. napus* seeds which were stored for less than 3 months and found that ≤ 0.02 % of seed samples were infected by *P. biglobosus*. Infected seeds mostly rotted before germination but those that germinated died before being established. Pseudothecia are often carried on seed or seed debris and at the right conditions, they produce the ascospores which are the infective stage (Kaczmarek and Jedryczka)

Organism type	Scientific name	Is it in NZ? Y/N	Seed-borne	Seed-transmitted	Notes on Biology/Life cycle
Fungus	*Plenodomus lingam*	Y	Y	Y	*P. lingam* (Syn *Leptosphaeria maculans*) was among the seed-borne pathogens observed in harvested varieties of *B. napus* which grown in large experimental plots (Remlein-Starosta et al. 2015). From 6 samples (100 seeds each) containing the pathogen, the percentage of infected seeds ranged between 6% and 28% (Remlein-Starosta et al. 2015). Dilantha et al (2016) examined *B. napus* seeds which were stored for less than 3 months and found that ≤ 0.04 % of seed samples were infected by *P. lingam*. Infected seeds mostly rotted before germination but those that germinated died before being established. Seed-borne infection is rare but still an important means of spreading the fungus, however spores are not likely to survive for more than six weeks on seed (West et al. 2001)
	Pyrenopeziza brassicae	Y	Y	Y (artificially)	Experimentally inoculating seeds with conidial suspension in the laboratory revealed that *P. brassicae* can be seed-borne as well as seed transmitted (Rawlinson et al. 1978). The percentage of seed transmission was not yet recorded but pathogen is not internally borne in seed embryo or testa (Rawlinson et al. 1978). Conidia are often transferred to seed surface by water splash but existence of the pathogen in infected dead plant parts (stems, pods and leaves) or debris is often the major means of continuing the cycle (Gilles et al. 2000).
	Plectosphaerella cucumerina	N	Y		Although the pathogen is known to infect *B. oleracea* plants (Li et al. 2017), there is no evidence that it affects B. napus plants. However, Heppner and Heitefuss (1995) showed that the pathogen may be seed-borne on B. napus at low levels (0.1% to 0.2%). The pathogen is not known to occur in New Zealand
	Sclerotinia sclerotiorum	Y	Y	No evidence found	*S. sclerotium* is seed-borne on *B. napus* but rare (Jaergensen 1994). More recent findings indicate that pathogen infects plant stems rather than seeds thus the sclerotia of *S. sclerotium* existing on plant debris may be transported along with seeds (Rollins et al. 2014).
Virus	*Turnip yellow mosaic virus*	N	Y	Y	Although mainly transmitted by insects (flea-beetles) (Markham and Smith 1949), this pest has also been observed in the field to be transmitted in seeds of *B. napus* (Špak et al. 1993). Špak et al. (1993) found that the percentage of infected seeds from plants that tested positive (by ELISA) for the virus ranged between 0.6% and 16 % (n=490-1002 seeds). They also found that percentage of seedlings that tested positive for the virus from seeds of infected plants ranged between 0.1% and 1.2% (n=524-767 seedings) (Špak et al. 1993). In other brassica crops de Assis Filho & Sherwood (2000) found that the virus colonizes both the seed coat and/or and that the virus is also seed transmitted.
Fungus	*Verticillium albo-atrum*	Y	Y	No evidence found	Heppner and Heitefuss (1995) examined *B. napus* seeds collected from different parts of Germany and showed that the pathogen is seed-borne at extremely low levels (0.01). Conidia produced from infected plants are often airborne and can infect other plants, additionally, the pathogen can produce microsclerotia which are often carried on plant debris and seeds for soil transmission (Fradin and Thomma 2006).

Organism type	Scientific name	Is it in NZ? Y/N	Seed-borne	Seed-transmitted	Notes on Biology/Life cycle
	Verticillium dahliae	Y	Y		Examination of *B. napus* seeds collected from different parts of Germany revealed that the pathogen is seed-borne at a low level i.e. 0.1% (Heppner and Heitefuss 1995). The pathogen can produce microsclerotia which are often carried on plant debris and seeds for soil transmission (Fradin and Thomma 2006).
Fungus	*Verticillium longisporum*	N	Y	No evidence found	Experimental inoculation provides evidence that *B. napus* seeds can carry microsclerotia of the pathogen after some days of exposure and may be viable years after (Zheng et al. 2019). However, the microsclerotia from the plant stems are the major means of continuing the cycle when they are released into the soil from decomposing plants (Depotter et al. 2016).
Bacterium	*Xanthomonas campestris* pv. *aberrans*	N	Y	No evidence found	Being a pathogen that spreads throughout the vascular system, *Xanthomonas campestris* in general are predominantly seedborne (internal and external), but also in dead plant debris which could be transported with seed (Schaad et al. 1980, Williams et al. 1980). They are also soilborne.
	X. campestris pv. *armoraciae*	N	Y		Being a pathogen that spreads throughout the vascular system, *Xanthomonas campestris* in general are predominantly seedborne (internal and external) but also in dead plant debris which could be transported with seed (Schaad et al. 1980, Williams et al. 1980). They are also soilborne.
	X. campestris pv. *campestris*	Y	Y	Y	Being a pathogen that spreads throughout the vascular system, *Xanthomonas campestris* in general are predominantly seedborne (internal and external) but also in dead plant debris which could be transported with seed (Schaad et al 1980; Williams et al 1980; Singh et al 2006). They are also soilborne. From a laboratory experiment, Roberts et al. (1999) reported that *X. campestris* pv. *campestris* is seed transmitted in Cauliflower and depending on inoculation dosage, a range of 2% to 54% of infected plants can emerge.
	X. campestris pv. *raphani*	N	Y	No evidence found	Being a pathogen that spreads throughout the vascular system, *Xanthomonas campestris* in general are predominantly seedborne (internal and external) but also in dead plant debris which could be transported with seed (Schaad et al. 1980, Williams et al. 1980). They are also soilborne.

Supporting information

ISPM 28: *International movement of seeds* includes the following definitions relevant to this technical advice:

- "Seed-borne" pests and diseases are defined as "*A pest* [or disease] *carried by seeds externally or internally that may or may not be transmitted to plants growing from these seeds and cause their infestation*"
- "Seed-transmitted" pests and diseases are defined as "*A seed-borne pest* [or disease] *that is transmitted via seeds directly to plants growing from these seeds and causes their infestation*"

Initially, the pathogens identified were found by searching the Emerging Risk System (ERS) alerts, a previously drafted list of *Brassica napus* pathogens (2013), International Seed Testing Association (ISTA) database, International Seed Federation (ISF) database, European and Mediterranean Plant Protection Organization (EPPO) global database, CABI and Google scholar. Search terms in Google scholar included seed-borne/seed-transmitted pathogens of '*Brassica napus* L.', '*Brassica napus* L. subsp. *napobrassica*', '*Brassica napobrassica*', '*Brassica napus* var *napobrassica*', '*Brassica oleracea* var. *napobrassica*', 'Argentine canola', 'annual rape canola', 'oilrape seed', 'summer rape', 'Swede rape', 'Swedish turnip', 'winter rape' and 'rape kale' but were not limited to the mentioned synonyms. Following the recent development of the Semi-Automated Potential Hazard List (SAPHL) system which searches all the databases listed above, the Web of Science and more, it was imperative to use this tool to find pathogens that were missed in the initial search.

The New Zealand status of the pathogens were confirmed by checking relevant databases: List of microbes in New Zealand (Environmental Protection Agency 2021), Official New Zealand Pest Register (ONZPR 2021), New Zealand Organisms Register (NZOR 2021), Plant Pest Information Network (PPIN 2021), NZfungi2 (Landcare 2021) and Verakoone et al. 2015. Additional searches were made in EPPO, CABI and GBIF when no results were found in the previously listed databases.

The synonyms, anamorphs and teleomorphs of the 23 seed-borne/seed-transmitted pathogens as well as their regulatory status in New Zealand are shown in Appendix 1. Further information about other potentially relevant pests which were excluded from Table 1 are shown in Appendix 2. These pests were excluded because there was either no strong evidence of their association with *B. napus* seeds or there were serious issues in their taxonomy.

Time: [redacted]

Reviewed by: [redacted]

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Appendix 1: Scientific names, synonyms, authorities, and regulatory status of *Brassica napus* seed-borne/seed-transmitted pathogens.

Organism	Scientific name and Authority	Synonym/Anamorph/Teleomorph	Regulatory status (ONZPR)
Oomycete	*Albugo candida*, (Pers.) Kuntze 1891	*Aecidium candidum*, Pers 1792; *Albugo cruciferarum*, (DC.) Gray 1821; *Albugo macrospora*, (Togashi) S. Ito 1935; *Albugo maugini*, (Parisi) Cif. and Biga 1955; *Caeoma candidum*, (Pers.) Nees 1816; *Cystopus candidus*, (Pers.) Lév 1848; *Uredo candida var. candida*, (Pers.) Pers 1801; *Uredo candida var. cruciferarum*, (DC.) D C 1815; *Uredo cruciferarum*, D C 1805	Some strains are regulated
Fungus	*Alternaria alternata*, (Fr.) Keissl. 1912	*Alternaria fasciculata*, (Cooke & Ellis) L R Jones and Grout 1897; *Alternaria rugosa*, McAlpine 1896; *Alternaria tenuis*, Nees 1816; *Macrosporium fasciculatum*, Cooke and Ellis, 1877; *Torula alternata*, Fr., 1832	Some strains and subspecies regulated
	Alternaria brassicae, (Berk.) Sacc 1880	*Alternaria alliariae-officinalis*, Săvul and Sandu 1933; *Alternaria exitiosa*, (J G Kühn) Jørst 1945; *Alternaria herculean*, (Ellis and G Martin) J A Elliott, 1917; *Alternaria macrospora var. macrospora*, Zimm 1904; *Alternaria saccardoi*, Sawada 1959; *Cercospora lepidii*, Peck 1884; *Cercospora moldavica*, Săvul and Sontea, 1946; *Dicaeoma brassicae*, (Mont.) Kuntze 1898; *Macrosporium brassicae*, Berk 1836; *Macrosporium herculeum*, Ellis and G Martin 1882; *Macrosporium macrosporum*, (A G Eliasson) Sawada 1959; *Polydesmus exitiosus*, (J G Kühn) J G Kühn 1858; *Puccinia brassicae* Mont 1836; *Rhopalidium brassicae*, Mont and Fr 1836; *Sporidesmium brassicae*, Massee 1901; *Sporidesmium exitiosum*, J G Kühn, 1855; *Sporidesmium ornii*, P Karst 1891	Non-regulated
	Alternaria brassicicola, (Schwein.) Wiltshire 1947	*Alternaria brassicae f. microspore*, Brunaud 1897; *Alternaria circinans*, (Berk and M A Curtis) P C Bolle 1924; *Alternaria oleracea*, Milbrath 1922; *Helminthosporium brassicae*, Henn 1902; *Helminthosporium brassicicola*, Schwein, 1832; *Macrosporium circinans*, Berk and M A Curtis 1867; *Macrosporium commune var. circinans*, (Berk and M A Curtis) Sacc 1886; *Polydesmus exitiosus f. alternarioides*, (J G Kühn) J G Kühn 1858; *Sporidesmium exitiosum f. alternarioides* J G Kühn, 1855	Non-regulated
	Alternaria ethzedia, E.G. Simmons 1986	N/A	Not listed in ONZPR
	Alternaria infectoria, E.G. Simmons 1986	N/A	Non-regulated

Organism	Scientific name and Authority	Synonym/Anamorph/Teleomorph	Regulatory status (ONZPR)
	Alternaria raphani, J. W. Groves and Skolko 1944	*Alternaria japonica*, Yoshii 1941	Non-regulated
Fungus	*Arthrinium arundinis*, (Corda) Dyko and B. Sutton 1979	*Apiospora arundinis*, (Corda) Pintos and P Alvarado 2021; *Gymnosporium arundinis*, Corda 1838; *Papularia arundinis*, (Corda) Fr 1849; *Coniosporium arundinis*, (Corda) Sacc 1880; *Melanconium sphaerospermum subsp. Arundinis*, (Corda) Grove1918	Non-regulated
	Botrytis cinerea Pers. 1794	*Gonatobotryum sclerotigenum* Van Walmero 1971; *Botrytis diospyri* Brizi 1901; *Polyactis vulgaris* Link 1809; *Phymatotrichum gemellum* Bonord 1851; *Botrytis citricola* Brizi 1903; *Botrytis furcata* Fresen 1859; *Botrytis fuckeliana* N.F. Buchw. 1949	Non-regulated
	Mycosphaerella brassicicola, (Duby) Lindau 1897	Dothidea brassicae Desm., 1842; Dothidea brassicae f. cochleariae Westend., 1866; Sphaerella brassicicola (Duby) Ces. & De Not., 1863; Sphaeria brassicicola Duby, 1830	Not assessed
Protozoan	*Plasmodiophora brassicae*, Woronin, 1877	N/A	Non-regulated
	Plectosphaerella cucumerina (Lindt.) W. Gams 1972	*Venturia cucumerina* Lindf. 1919; *Monographella cucumerina* (Lindf.) Arx 1984; *Cephalosporiopsis imperfecta* Moreau & V. Moreau 1941; *Septomyxa affinis*, Wollenw., 1924; *Microdochium tabacinum* (J.F.H. Beyma) Arx 1984	Non-regulated
Fungus	*Plenodomus biglobosus*, (Shoemaker and H. Brun) Gruyter, Aveskamp and Verkley 2012	*Leptosphaeria biglobosa*, Shoemaker and H Brun 2001; *Phoma wasabiae*, Yokogi 1933; *Plenodomus wasabiae* Yokogi ex J F White and P V Reddy 1999	Not listed in ONZPR
	Plenodomus lingam, (Tode) Höhn.1911	*Depazea brassicae*, Sacc.1884; *Heptameria maculans*, (Ces and De Not) Cooke 1889; *Leptosphaeria alliariae*, (Auersw) Rehm 1883; *Phoma brassicae*, Thüm.1884; *Phoma lingam*, (Tode) Desm.1849; *Phoma napobrassicae*, Rostr 1892; *Phoma oleracea* Sacc 1880; *Phoma oleracea var. antirrhini*, Sacc.1884; *Phyllosticta brassicae*, Westend 1851; *Phyllosticta napi*, Sacc.1879; *Leptosphaeria maculans*, Ces and De Not 1863; *Pleospora maculans*, (Ces. & De Not.) Tul and C Tul 1863; *Sphaeria brassicae*, Pers ex Curr 1859; *Sphaeria lingam*, Tode 1791; *Sphaeria maculans*, Desm.1846; *Sphaeropsis lingam*, (Tode) Mussat 1901	Not assessed
	Pyrenopeziza brassicae, B. Sutton and Rawl. 1979	*Cylindrodochium concentricum*, (Grev.) Bonord.1851; *Cylindrosporium concentricum var. macrosporum*, Bat and Peres 1964; *Gloeosporium concentricum*, (Grev.) Berk and Broome 1850	Non-regulated

Organism	Scientific name and Authority	Synonym/Anamorph/Teleomorph	Regulatory status (ONZPR)
Virus	*Turnip yellow mosaic virus* (TYMV), Markham and Smith 1949	N/A	Regulated
Fungus	*Verticillium albo-atrum* Reinke & Berthold 1879	*Verticillium albo-atrum* var. *caespitosum* Wollenw. 1929; *Verticillium albo-atrum* var. *caespitosum* Rudolphi?	Non-regulated
Fungus	*Verticillium dahliae* Kleb. 1913	*Verticillium albo-atrum* var. *dahliae* (Kleb.) R. Nelson 1950; *Verticillium ovatum* G. H Berk and A. B. Jacks 1926; *Verticillium trachelphilum* Curzi 1925; *Verticillium albo-atrum* var. *medium* Wollenw. 1929	Non-regulated
Fungus	*Verticillium longisporum*, (C. Stark) Karapapa, Bainbr. and Heale 1997	*Verticillium dahliae* var. *longisporum*, C Stark 1961	Not listed in ONZPR
Bacteria	*Xanthomonas campestris*, (Pammel, 1895) Dowson 1939	*Bacillus campestris*, Pammel 1895 *Bacterium campestre*, (Pammel) Smith 1897 *Phytomonas campestris*, (Pammel) Bergey et al. 1923 *Pseudomonas campestris*, (Pammel) Smith 1897	
	X. campestris pv. *aberrans*, (Knösel, 1961), Dye 1978		regulated
	X. campestris pv. *armoraciae*, (McCulloch 1929) Dye 1978		regulated
	X. campestris pv. *campestris*, (Pammel, 1895) Dowson 1939		non-regulated
	X. campestris pv. *raphani*, (White 1930) Dye 1978		not listed in ONZPR

Appendix 2: Other potentially relevant pests found in Google Scholar (Gscholar), the Emerging Risk System (ERS), a previous (2013) Draft Pathogen List of *Brassica napus* (DPLBn) and the Semi-Automated Potential Hazard List (SAPHL).

Organism type	Species	Source	Reason
Fungus	*Cladosporium spp*	Gscholar	Alpaslan and Ozer (2017) recorded this as a seed-borne pathogen of *B. napus*. Spores of some *Cladosporium* species can be air-borne or water-borne and may settle on seed or seed debris. Some species of this genus are present in New Zealand.
Fungus	*Curvularia spp*	Gscholar	This pathogen was also listed among seed-borne pathogens of *B. napus* (Alpaslan and Ozer 2017). The conidia of some *Curvularia* species are either carried by air or water and can settle on the soil, seed or seed debris (Manamgoda et al. 2015). Most *Curvularia* species listed on NZOR have not been reported in New Zealnd and the species of this genus which associates *B. napus* is yet to be determined.
Fungus	*Fusarium spp*	Gscholar	Alpaslan and Ozer (2017) listed Fusarium spp among the seed-borne pathogens of *B. napus*. *Fusarium* spores in the form of microconidia, macroconidia or chalamydospores are often airborne and may settle on seed, plant debris or the soil (Ma et al. 2013). Most of the Fusarium species listed on NZOR are present in NZ but some of them are regulated (ONZPR)
Fungus	*Phomopsis spp*	Gscholar	Alpaslan and Ozer (2017) also listed *Phomopsis spp* among the seed borne pathogens of *B. napus*. Conidia of *Phomopsis* species are often dispersed by rain or water splashes and can settle on seed or plant debris (Udayanga et al. 2011). Most *Phomopsis* species listed on NZOR have not been reported in New Zealand and the species of this genus which associates with *B. napus* is not known.
Bacterium	*Candidatus phytoplasma*	ERS	*C. Phytoplasma* (which include the asteris, solani and trifoli strains) is listed as a seed-borne pest of *B. napus* in the ERS alert ID 4271-1 based on studies from Calari et al. (2011), Olivier et al. (2006), Bertaccini et al. (2014) and Satta (2017). However, a recent risk assessment with the ERS alert ID 8526 (August 2021) clearly indicates that the pathogen is not seed-borne. Like other *phytoplasmas*, is predominantly transmitted by insect vectors or mechanically, through vegetative propagation (Hogenhout et al. 2008; Bertaccini et al. 2014). Additionally, Dr. Lia Liefting, a Principal Scientist at MPI's plant health and environment laboratory (PHEL), also an expert on Phytoplasmas, confirmed that they are not seed-borne.
Fungus	*Ascochyta brassicae*	DPLBn	There is no evidence to suggest that *Ascochyta brassicae* is a pest of *B. napus*, but it has been recorded as a pest of *Brassica oleraceae* (Farr and Rossman 2021).
Fungus	*Curvularia brassicae*	DPLBn	Although a *Curvularia* species was observed on Brassica napus (Asplan and Ozer 2017), it is still not known if it is the same with *Curvularia brassicae*. However, this pest has been associated with seeds of *Brassica oleracea* var. *botrytis* (Index Fungorum 2021).
Fungus	*Leptosphaerulina brassicae*	DPLBn	There was no evidence of association between this pathogen and *B. napus*. However, it has only been observed on leaves of *Brassica nigra* (Karan 1964).
Fungus	*Pseudomonas brassicaevora*	DPLBn	There was no record of this pest anywhere on the internet. The two *Pseudomonas* species associated with *B. napus* are *P. brassicacearum* sp. nov and *P. thivervalensis* sp. nov which associate with the roots of the host (Achoak et al. 2020)
Fungus	*Tylenchorhynchus brassicae*	DPLBn	Members of the genus *Tylenchorhynchus* have a variety of hosts (Handoo 2000) and *Tylenchorhynchus brassicae* in particular, is known as a pest of tomato and eggplant (Khan et al. 1986a, 1986b) but there is no evidence to suggest that it is pest of Brassica napus.

Organism type	Species	Source	Reason
Oomycete	*Aphanomyces brassicae*	DPLBp	There is no evidence that Aphanomyces brassicae is a pest of Brassica napus even though it is known to be a pest of Cabbage (*B. oleracea*), turnip (*B. rapa*) and Mustard (*B. campestris*) (Grünwald 2003).
Oomycete	*Peronospora brassicae f. major*	DPLBp	The genus *Peronospora* is currently known as *Hyaloperonospora*, thus *P. brassicae* is now *H. brassicae* (Mohammed et al 2018). Although this pest is common in *B. napus* and other *Brassica* species (Mohammed et al 2018), there is no evidence that it is seed borne. The sporangia occur from the infected regions often end up in the soil and the cycle continues. *Peronospora brassicae f. major* in particular has only been recorded as a pest of *Brassica oleracea* (Constantinescu 1991).
Virus	Brassica virus 1	DPLBp	No record of 'Brassica virus 1' was found in EPPO, GBIF, Google Scholar, ERS Alerts, CABI and ICTV. The closest viruses include *Brassica campestris chinensis* coguvirus 1 (BCCoV1) and *Brassica campestris* chrysovirus 1 which are only known to associate with *Brassica rapa* and *Brassica rapa* var. *purpurea* respectively (Zhang et al. 2017, Tang et al 2021).
Bacterium	*Curtobacterium flaccumfaciens*	SAPHL	*Curtobacterium flaccumfaciens* pv. *flaccumfaciens* predominantly a pathogen of common bean examination of other possible hosts that can allow the pathogen to survive longer in the filed showed that *B. napus* plants can be infected by the pathogen (Gonçalves et al 2017). The pathogen is often soilborne, seedborne or on dead plant debris (Gonçalves et al 2017). However, there is no evidence that it is seed-borne in *B. napus* and the pathogen is not known to occur in New Zealand.
Bacterium	*Pseudomonas viridiflava*	SAPHL	Although this pathogen is seed-borne in some plant species (CABI 2021) there is no evidence that it is seed-borne in *B. napus* and the pathogen it is present in New Zealand. However, the bacteria is a known pathogen affecting *B. napus* leaves (Bell et al 2021).
Fungus	*Aspergillus amstelodami*	SAPHL	The storage pathogen is known to invade stored *B. napus* seeds (Schaps et al. 1982) but there is no evidence that it infects the plants. The pathogen occurs in New Zealand.
Fungus	*Aspergillus flavus*	SAPHL	This cosmopolitan pathogen was observed among the contaminant pathogens of *B. napus* seeds stored for six months (Kesho and Abebe, 2021). However, there is no evidence that the pathogen affects the plants, and it is a common storage pest. The pathogen is present in New Zealand.
Fungus	*Aspergillus niger*	SAPHL	This stored product fungus was experimentally inoculated on leaves of *Brassica rapa* (Abdel-Farid et al. 2009) but there is no evidence of natural infection on seeds and it is present in New Zealand.
Fungus	*Bipolaris sorokiniana*	SAPHL	Experimentally seed transmitted in *B. campestris (sarson)(syn. B. rapa)* when the seeds were inoculated with the pathogen but there is no evidence of the pathogen's natural occurrence in *Brassica* spp. See Iftikhar et al. (2009). The pathogen predominantly affects cereal crops (Al-Sadi 2021) and it occurs in New Zealand.
Fungus	*Fusarium oxysporum*	SAPHL	*F. oxysporum* was observed among the contaminant pathogens of *B. napus* seeds stored for six months (Kesho and Abebe, 2021). Although Gaetan (2009) showed that *F. oxysporum f. sp. conglutinans* causes *Fusarium* wilt on *B. napus* plants, infected plants do not produce seeds. Additionally, it is not clear if *F. oxysporum f. sp. conglutinans* was the pest observed by Kesho and Abebe (2021). *F. oxysporum* and *F. oxysporum f. sp. conglutinans* occur in New Zealand.
Fungus	*Pythium aphanidermatum*	SAPHL	this fungus is known to affect *B. napus* plants (Misra and Hall 1996) but it is only known to be seed-borne in *Brassica nigra* (black mustard) (Shahi and Yadav, 2010). There is no evidence that it is seed-borne in *B. napus* and the pathogen does not occur in New Zealand

Organism type	Species	Source	Reason
nematode	*Ditylenchus dipsaci*	SAPHL	The nematode is present in New Zealand but there are some potentially parasitic races/strains which are currently not in New Zealand. Although the nematode is known to associate with *Brassica napus* roots (Iurcu-Străistaru et al 2012), there is no evidence of its association with the seeds. However, it is known to be transmitted in seed or seed debris of lucerne and field beans (Hooper 1941, Mouttet et al 2014, CABI 2021).
Oomycete	*Hyaloperonospora parasitica*	SAPHL	Viable oospores of this pathogen are often found in *B. napus* plant debris and the pathogen infects *B. napus* plants at the seedling stage (EPPO Standards rape datasheet 2021). There is no evidence that it is seed-borne even though Thines and Kumar (2013) point that members of the *Hyaloperonospora* genus can have systemic infections and affect floral and non-floral parts of plants. The pathogen occurs in New Zealand
Virus	Turnip mosaic virus	SAPHL	Observed in *B. napus* during general surveillance in 2002 but there was no mention of the plant part which it was found on (LIMS 2021). Present in Present in New Zealand (Verakoona et al. 2015) but not seed transmitted (Walker et al. 2016).
Athropod	*Acarus siro*	SAPHL	Stored product pest, occurs in New Zealand.
Athropod	*Ceutorhynchus obstrictus*	SAPHL	Affects only *B. napus* pods, not listed in NZOR/PPIN/NZ land invertebrates.
Athropod	*Dasineura brassicae*	SAPHL	Affects only *B. napus* pods, not listed in NZOR/PPIN/NZ land invertebrates.
Athropod	*Listronotus bonariensis*	SAPHL	Life cycle only completed in grass host plants (EPPO 2021); pests may contaminate poaceae seeds but no evidence of contaminating *B. napus* seeds. The pest occurs in New Zealand.
Athropod	*Trogoderma granarium*	SAPHL	Stored product pest, contaminates and affects seeds of many plant species unlikely to go beyond store environments. No evidence of occurrence in New Zealand and it is a regulated pest.
Plant	*Alopecurus myosuroides*	SAPHL/CABI	Seed contaminant, sometimes present (Nzplants/NZOR).
Plant	*Avena fatua*	SAPHL/CABI	Seed contaminant, occurs in New Zealand.
Plant	*Cirsium vulgare*	SAPHL/CABI	Seed contaminant, occurs in New Zealand.
Plant	*Erigeron canadensis*	SAPHL/CABI	Seed contaminant, occurs in New Zealand.
Plant	*Lolium multiflorum*	SAPHL/CABI	Seed contaminant, occurs in New Zealand.
Plant	*Lolium rigidum*	SAPHL/CABI	Seed contaminant, occurs in New Zealand.
Plant	*Lolium temulentum*	SAPHL/CABI	Seed contaminant, occurs in New Zealand.
Plant	*Orobanche ramosa*	SAPHL/CABI	Seed contaminant, no evidence of occurrence in New Zealand and regulated.
Plant	*Phragmites australis*	SAPHL/CABI	Seed contaminant, occurs in New Zealand.
Plant	*Rumex hypogaeus*	SAPHL/CABI	Seed contaminant, not listed in NZOR/PPIN/NZ land invertebrates.