Discussion Document for the Importation of Dried and Preserved Plant Material

MAFBNZ Biosecurity New Zealand Discussion Paper

February 2010

Submissions

MAF Biosecurity New Zealand invites comments on the options for managing risks for future imports of these commodities.

This publication is available on the MAFBNZ website at www.biosecurity.govt.nz

Additional information on 'Making a submission' can also be viewed from this web page.

Disclaimer

While every effort has been made to insure that the information herein is accurate, the Ministry of Agriculture and Forestry does not accept liability for error of fact or opinion which may be present, nor for the consequences of any financial decision based on this information.

1. INTRODUCTION

The purpose of this document is to outline the risks associated with dried and preserved plant material and discuss how MAFBNZ considers these are mitigated by the requirements. The new Import Health Standard (IHS) is being developed to accommodate low risk plant products currently not included in other Import Health Standards. This IHS will serve as a framework for all forms of dried or preserved plant material and miscellaneous dried or manufactured plant items not intended for human or animal consumption, or generally not intended for fertiliser/growing media use, and not covered under an existing import health standard.

This document discusses the risks associated with the following groupings of dried and preserved foliage into New Zealand, including:

- powdered plant material and liquid extracts;
- dried plant material for further processing;
- dried cut flowers and foliage for ornamental purposes;
- freeze dried flower arrangements/products for ornamental purposes;
- miscellaneous dried floral items for ornamental purposes; and
- miscellaneous processed items made from or including dried plant material for various purposes.

This standard does not cover the requirements for importation of the following commodity classes:

- Importation of Fresh Cut flowers and foliage – MAFBNZ import health standards 155.02.04 and 152.09.05;
- Importation of non-perishable plant material for human consumption – BNZ-NPP-HUMAN Importation into New Zealand of Stored Plant Products Intended for Human Consumption;
- Importation of wood, wood products, bamboo, cane, willow and rattan, covered in various MAFBNZ import health standards for non-propagable forest produce;
- Importation of dried flowers and foliage for laboratory analysis/testing. A restricted biological products permit is required for such samples;
- Miscellaneous highly processed items derived from plants, organic materials derived from minerals, fertilisers, composts and inorganic substances; and
- Importation of any product containing live micro-organisms e.g. legume/seed inoculants and mushroom spawn. These products may be imported under a permit to import for micro-organisms.

2. BACKGROUND

Under section 22 of the Biosecurity Act, the issue of an import health standard for risk goods is necessary for the management of biosecurity risks. While previous clearance in the absence of a suitable import health standard has been possible under the Biosecurity Act generally by substantially confirming there is no risk, a wide ranging standard will allow for better management and record keeping in future. It is important that guidelines are available to distinguish between those product groups or items which are considered to be of sufficiently low risk that no biosecurity measures are required, and those products where biosecurity requirements are considered necessary.

Importation has been previously managed by internal lists, permits to import, and official correspondence confirming biosecurity clearance assuming basic information is provided. Many products covered under this IHS have been imported for years and little change is being made to existing requirements. This framework will outline the requirements for various groupings of products. Most groupings are products that are considered to be of extremely low biosecurity risk because the products are either processed to the point of little risk, or are dried and currently being either inspected or treated on arrival.

Historically, where risk has been perceived in the past, either a permit to import will have been issued or entries made in the internal process procedures. With some items or groupings where there is insufficient information available, a treatment is the preferred action. Inspection has been and will remain an important action and where necessary also a treatment for likely biosecurity risks.

Treatments have been widely used to satisfy MAFBNZ that the products are clean and free of contamination from viable plant material.

No formal risk analysis or compilation of pest lists has been undertaken for the commodities covered by this standard, apart from a risk analysis input into effects of dyeing, bleaching and freeze drying in this context. The products considered here are not a priority for a risk analysis because the products are highly processed and very few host-associated organisms are likely to be found with any of the products covered under this IHS. Consequently the treatments are adopted for devitalising all organisms over a wide scope. It is not sensible to put resources into risk assessments for these dried products when compared with the higher risk pathways of fresh plant material. Results of many years of inspections show that the most likely form of risk is contamination or viable material of untreated and unassessed new species.

3. HAZARDS

Hazards are organisms that could be introduced into New Zealand and are capable of, or potentially capable of, causing unwanted harm. The hazard identification process often begins with the collation of a list of organisms associated with the commodity. This is usually derived from scientific literature on the organisms associated with the original plant or the commodity in each country of origin. This approach is not feasible for the dried and preserved plant products pathway because it would be an uneconomic use of resources with regard to the risk and value of these products.

An additional approach to hazard identification is to analyse records of border and post-border interceptions of organisms on imported dried and preserved plant products. This provides direct evidence of association with the pathway, but does not provide a complete list of potential hazards.

One type of hazard associated with these products may be hitchhikers that become associated with the products during storage or transport like domestic pests such as spiders and ants which can occur on imported products depending on how and where they are stored prior to export. Other hazards are unintentional importation of viable seeds of new, unwanted (prohibited) or regulated species as part of the item or as contamination, fungal diseases and soil contamination. Specific hazards for different commodity types are explained in Section 5.

Interception and treatment records have been examined as a whole but as these depended on the information provided with the products, it has not been possible to summarize any treatment data meaningfully. A summary of live genera/species recorded in identification data for products directly related to this standard is given in Appendix 3, unsorted with regard to the major product groupings of the standard. These identified organisms are listed in the identifications database which started in 2003, mostly relating to identifications made prior to about 2000 by the laboratories and subsequently entered. Policy changes in more recent years mean importers have been given choices of identification or treatment for interceptions at the border. Treatment has often been chosen, reducing considerably the number of laboratory identifications available since 2001. Identifications not made below family level and data thought to relate to fresh rather than dried material are not included.

4. REVIEW OF POTENTIAL BIOSECURITY MEASURES

A number of measures are available to MAFBNZBNZ to mitigate the risks associated with dried and preserved plant products. These measures involve requesting certification including descriptions of processing systems, visual inspection, and various treatment methods. In addition, periodic surveys can be undertaken by MAFBNZBNZ to check that requirements are still suitable or effective. The specific measures proposed for each commodity type are discussed in section 3.

4.1 Certification

Phytosanitary Certificate

The issuance of a phytosanitary certificate by the National Plant Protection Organisation (NPPO) of the country of origin is a suitable condition to ensure that the requirements of the relevant import health standard have been met by the exporting country. A phytosanitary certificate can be used to ensure that the NPPO of the exporting country has visually inspected the consignment for the presence of regulated pests, where this is deemed necessary.

Permit to Import

A permit to import provides a way of managing the importation of these types of products on a case-by-case basis where desirable, allowing for assessment of a specific product. For example, if a particularly unusual form of processing or treatment has been used with particular items in such a way that all risks will be mitigated but the situation falls outside the previously considered prescriptive requirements for that item, a permit could be used. Permits can provide extra control, allowing for a desk audit of processing information supplied at the time of application and providing opportunity to seek more information where necessary. Most importantly they convey the approval to all parties: the importer, supplier and quarantine inspector. A permit can be usefully employed as a stepping stone to additions to the standard.

Manufacturing Certificate

A manufacturing certificate is a useful requirement to confirm that any processing parameters comply with the requirements of MAFBNZ and mitigate possible biosecurity risks. A certificate from the manufacturer can also be useful to confirm identity and composition of the product. It is often not possible to have this information confirmed on a phytosanitary certificate (PC) either because the exporting country does not regard such a processed product as a risk material item or because the processing is beyond any government control with the NPPO not in a position to confirm.

Treatment Certificate

In keeping with the acceptance of treatment certificates for some other products and pathways, they can be accepted in this standard for many of the products.

4.2 Visual Inspection

Visual inspection by a trained inspector can be used in three main ways for managing biosecurity risks on goods being imported into New Zealand, as:

- a biosecurity measure, where the attributes of the goods and hazard organism provide sufficient confidence that an inspection will be able to achieve the required level of detection efficacy;
- an audit, where the attributes of the goods, hazard organisms and function being audited provide sufficient confidence that an inspection will confirm that risk management has achieved the required level of efficacy;
- a biosecurity measure in a systems approach, where the other biosecurity measures are not able to provide sufficient efficacy alone or have significant levels of associated uncertainty.

Visual inspection can take place along a whole production pathway. Monitoring of a production system is considered good practice, but for most of the products that come within this IHS the risks is too low for consideration of how this can be managed offshore.

Pre-export inspection: MAFBNZ may require that the NPPO of the exporting country samples and visually inspects the consignment for all regulated pests.

On arrival inspection: This is carried out in the destination country on arrival. The purpose of these inspections is to determine whether any potential quarantine pests are associated with the consignment.

Detection of regulated pests will result in the consignment being subjected to appropriate remedial action, which will reduce the risk to a very low level. This action would involve any treatment known to be effective against the target pests or diseases.

With the necessity in more recent years for approval and registration of premises for the holding and inspection of risk goods, it is essential for trade that there be clarity over which goods require inspection and in which circumstances. Fequent importions by the same importer, may result in a lower rate of inspection for some products over time. Unaccompanied goods requiring inspection becomes another cost to the importer. In comparison, for plant material accompanying passengers through the border, inspection of each consignment for some products, as an action to visually confirm cleanliness and freedom from contaminants is effective. The majority of these are small and "one-off" consignments.

4.3 Treatments

A series of treatment options are available for mitigating the risks of contaminants. These treatments may be conducted either prior to export or on arrival in New Zealand depending on their availability in each of the countries.

The effects of treatments on the commodity may in some cases be damaging or alter the appearance. Where it is considered this is a possibility, a trial treatment should first be arranged.

Methyl Bromide

Methyl bromide fumigation is known to be effective against a range of pests, particularly arthropods, and is relatively easy to apply. Methyl bromide fumigation is available in many exporting countries or on arrival in NZ. But in line with the Montreal Protocol, to phase out its use, methyl bromide will not be listed as a pre-export requirement unless the requirement has previously been in place e.g. for Melaleuca brushwood panels from Australia. Otherwise it will continue to be used as a treatment on arrival for arthropods intercepted during inspection, in accordance with the MAFBNZ Standard: Approved Biosecurity Treatments for Risk Goods Directed for Treatment.

The reported effectiveness of methyl bromide as a quarantine treatment for seeds is variable. Based on trials done on the devitalisation of seeds, many weed seeds are likely to survive fumigation with methyl bromide (Biosecurity Australia 2002; Cassells 1995). However, work carried out by AsureQuality New Zealand (2002) to find methods for devitalising seed contaminants in dried sphagnum for export to Australia showed that by using a rate of $80g/m^3$ for 72 hrs at 21°C, adequate effectiveness was achieved if applied correctly, but recent trials to test effectiveness on weed viability in compressed coco peat proved the treatment to be inadequate (Bullians et. al. 2009).

Heat Treatment

Heat treatment, involving either steam or low humidity treatment maybe applied to consignments to devitalise seeds or kill other contaminants. Heat treatment at the rate of 85ºC core temperature for 15 continuous hours is currently being used on a range of plant products. This type of treatment is considered as a suitable alternative when faced with reshipment or destruction of a consignment. Heat treatment has the advantage of treating both internal and external contaminants and those that may not be identified in standard visual inspection procedures. Heat treatment at these rates is considered to be an effective measure for the devitalisation of seeds (MAFBNZ Treatment Standard, 2008). Heat treatment at lower rates, such as the forestry alternative to fumigation of more than 4 hours at a minimum continuous core temperature of 70°C, or the rate of 85°C core temperature used for some products when entering Australia, are suitable when there is no likelihood of seeds to be devitalized.

Autoclave treatment is also listed in the standard as an option if contamination is found. Autoclaving would be conducted at a minimum of 121ºC for 30 minutes at 100KPa.

Irradiation

Gamma irradiation carried out at high doses (25kGy) is an effective treatment for seeds and other organisms in non-edible products (Marsh, Wilkins, Wynn-Williams/Canensis), This rate is currently in use in the MAFBNZ standard: Importation of Grain/Seeds for Consumption, feed or processing, Plant Health Requirements, but is not available in many countries. Irradiation can devitalise seeds in a

shorter timeframe than heat treatment and is less likely to cause damage to the product. Irradiation is an expensive treatment option, but can be used for specific high value products or ingredients.

Freezing

Deep freezing is currently accepted as an approved treatment for insects directed for treatment on arrival and is outlined in the MAFBNZBNZ Treatment Standard.

Dyeing

It is recommended that the process of dyeing dried foliage by fully immersing the item for 3 minutes in an aqueous dye whilst maintaining a near-boiling temperature (between 80 and 100°C) will likely destroy any contaminating conidia and mycelia occurring on or in the plant part. Dyes that have a non-aqueous base can be applied without heat**.** If the paperwork has the appropriate declaration to describe this proposed hot dyeing process, it is recommended that no further action will be required for entry into New Zealand and an inspection for contaminants will not be required.

Dyed ornamental plant material (no seeds) has previously been accepted without further treatment when declared to have been dyed in this manner. See Appendix 4 for further notes and discussion of dyeing as a precautionary treatment for fungal contamination.

Bleaching

It is recommended that the proposed bleaching treatment, entailing soaking the material in a solution of 3% NaOCl at room temperature for at least 8 hours, is likely to be sufficient to destroy many or most fungi occurring on dried plant material. If the paperwork has the appropriate declaration to describe the proposed bleaching process, it is recommended that no further action will be required for entry into New Zealand and an inspection for contaminants will not be required.

Bleached ornamental plant material (no seeds) has prevsiouly been accepted without further treatment when declared to have been bleached in this manner. See Appendix 4 for further notes and discussion of bleaching as a precautionary treatment for fungal contamination.

Freeze drying

Cut flowers commercially processed by freeze dyeing, but not containing any cones, capsules, seed head or seeds, have been previously accepted when accompanied by a manufacturer's certificate outlining the process involving vacuum freezing, as follows: frozen to -20ºC and then dried by changing the atmospheric pressure over a 10-14 day cycle. It is proposed that this acceptance with documentation continue. If the freeze dried cut flowers or other material are likely to contain cones, capsules, seed head or seeds it is recommended that commercial freeze-drying be preceded by dipping in a pre-soak solution for at least 24 hours. It is considered this process will be sufficient to destroy seed viability for many types of seeds in consignments intended to be exported as dried ornamental plant arrangements. If the manufacturer's certificate has the appropriate declaration to state the freeze drying process and where seeds might be included, that the dried plant material has undergone the proposed pre-soak/imbibing process followed by freeze-drying, it is recommended that no further action will be required for entry into New Zealand. See Appendix 4 for further notes and discussion of freeze drying for seed devitalisation.

5. COMMODITY SPECIFIC HAZARDS AND POTENTIAL MEASURES

5.1 Dried material milled to a fine powder and liquid plant extracts

Grinding any material into a powder or extracting chemicals into a liquid will greatly reduce biosecurity risks. Documentation is required to list the ingredient/s, declare the powder or liquid form of a product and that it does not contain any living organisms. Any powdered or ground material without adequate documentation will be regarded as a risk.

An inspection of powders and liquids is regarded as low value as they are unlikely to have any associated pests or contamination. No interceptions or post border reports have been found for these products.

5.2 Dried plant material for further processing

This section provides for the importation of dried plant material for further processing into health products, pharmaceuticals and other preparations. Generally these are not intended for human consumption, but may include finished products in the form of capsules/tablets for consumption.

Current Measures
All material is inspected on arrival. Currently a small number of importers are importing and processing their material under a permit and transitional facility. Others are importing with inspection on arrival, trusting that the material will be found clean and choosing not to import any new organisms or prohibited material.

Proposed measures
A range of likely items imported for this purpose are included in Appendix 1 below to indicate the typical range and type of such material and species involved, which includes prohibited and new species. This table includes species currently known to have been imported or requested in recent years for the purposes of further processing. A list will not be included in the standard, because additions would always be required. Instead a set of guidelines will be used rather than attempts to analyse risk for each type of item. A combination of inspection or processing in a transitional facility fit for purpose based on assessment of the processing procedure will be used. A set of generic situations is provided where it is considered there is a greater risk and material must be processed in a transitional facility.

Almost all this material is commercially dried, cut, chopped or shredded before packaging and therefore presents little risk. Typical package sizes for dried herbs are 500g, 1kg and bags up to 25kg. Inspection of material to check for contaminants at the border is desirable if the consignment is not being processed in a TF. With material that is commercially prepared and packaged in quantities up to 25kg being processed in a TF, a trained approved person will carry out the inspection at the TF. Arthropod risk is considered to be too low to justify inspection at the border as well. Should any motile pests be present and migrate from their packaging prior to processing, they can be treated by the facility operator under the TF operating manual instructions. Risks presented by fungi or seed will be removed through sufficient processing.

Consignments comprising seeds of the intended material which are regulated or prohibited in the MAF Plant Biosecurity Index (PBI) will require processing in a TF. Contaminant seeds considered to be a new species can be also managed by requiring either suitable processing in a transitional facility or destruction by rendering non viable at the border. For non-flowering plant groups in the lower part of the plant kingdom, e.g. fungi and seaweeds, MAFBNZ considers that because less may be known about these “lower” groups, a generic approach of requiring fit for purpose processing in a TF is the best requirement. Commercially prepared and packaged ground or finely chopped bark for processing will be acceptable with inspection. Coarsely cut or larger pieces should be heat treated or processed in a TF. A recent consignment of Arnica Montana was not commercially packaged and was noticeably infested with insects. Size of pieces was about 10 cent pieces.

5.3 Dried flowers, foliage, fruits and other plant parts for ornamental purposes, including pot pourri

This section includes single items and multiple items but it is not always practical to separate the constituents of mixtures of species and types, when prepared into arrangements, bouquets, wreaths and other decorations.

Many plants and parts of plants can be used for decorative purposes. The range extends from dried leaves, stems, flowers, fruits (including berries, woody cones), seed heads, seeds (including grains), woody fungi, dried mosses, lichens, and vegetables to any part of a plant that can be dried and has ornamental appeal. Flowers which dry well and have attractive features make a listing different from those that are popular as fresh flowers, but there are some that are popular in both forms. Most fresh cut flowers harvested for their showy, colourful petals will not have mature seed at harvest. MAFBNZ regulations for the importation of fresh cut flowers are based primarily on non-propagability of the stems with inspection for freedom from insect pests.

A list of examples of some of the popular dried flowers is provided in Appendix 2, to show the typical range of such material. Environmentally undesirable genera and those of high economic importance are well represented, showing the need for treatment of viable material. The list has been compiled from web sites, Australian wild flower information and previous importations.

Current Measures
Most material is inspected on arrival. A small internal listing for individually packaged dried cut flowers has existed for more than 10 yrs, but has never been updated. Since the introduction of the PBI, MAFBNZ inspectors have been referring to this Index for determining any seed risk. Most pot pourri and other mixed products are heat treated on arrival. Only one permit to import has been issued for commercial consignments, which takes into account treatments carried out offshore and irradiation in Australia.

The naming of dried plant parts and pieces can traditionally be with a common name, a latin but not scientific name or a generic or full scientific name. Different methods of drying and preserving are used from simple sun drying to freeze drying and soaking in glycerine preparations. Dyeing is very common, usually done in very hot water to break down the wax surface of the cuticle which swells the plant fibres allowing for dye migration. http://www.dry-flowers.net/dyeing-dry-flowers.html. Bleaching is also used to contrast with dyed forms. Product fumigated with methyl bromide offshore will generally still require inspection on arrival for other contaminats, unless assessed material is imported with a permit.

Material used in pot pourri includes flower petals, flower buds, mini pods, nuts, kernels, citrus peel, fruits, and hard woody fruiting bodies like small cones and capsules. Pot pourri statistics for the last 5 years show 72 entries. The majority of consignments came from Australia. The actual ingredients are usually imported into Australia, many from India, and repackaged for NZ as required. As these ingredients receive a treatment of either heating to similar specifications as NZ or irradiation, it is reasonable to allow consignments into NZ without further treatment if a manufacturer's declaration and copies of treatment certificates are provided. From other countries a treatment takes care of unknown risks.

Proposed measures
A generic approach has been taken here to provide guidelines for importation. Confirmation of a non-viable state can be more difficult with the wide range of material involved, but can be either worked through with available guidelines or a precautionary treatment given. In some circumstances a treatment will not be required. In other instances for large commercial importations of single items, a provision for the issue of a permit based on consideration given to detailed information supplied by the importer for a permit will allow for some flexibility.

It is not desirable to attempt to maintain a list of allowable dried flowers and plant parts because the list would require constant additions with considerable name duplication and synonymy. An example of a detailed exercise to evaluate risks of specified species of dried cut flowers can be seen in the Biological Dossier on Dried Australian and Foliage for Export (BA and AQIS 2003). In this document such factors as seed maturity at the time of harvest, inherent dormancy, and specific requirements for germination and climatic differences between the supplying and importing countries are considered.

Mixtures are much harder to inspect and label accurately with ingredients. The use of freeze drying involving a rapid freezing and subsequent drying for bouquets is increasing and seen by MAFBNZBNZ as a valuable treatment for both bouquets or single flower types when carried out by commercial operators with appropriate documentation. With pot pourri also, considering the range of typical ingredients, products should be treated to save resources involved with attempting to work through possible requirements for each mix.

Conversely, single items comprising homogenous individually wrapped or packaged items, including bunches of dried stems/foliage/flowers/fruiting parts, may be imported in accordance with the list of guidelines. For biosecurity purposes naming to species level is not necessarily important in all cases but a name to genus level should be required to help inspectors work through guidelines. In general the same reasoning can be applied to pot pourri as other mixtures, also allowing for a permit to be used to help piece together documentation when complex offshore treatment arrangements are accepted by MAFBNZ on a case by case basis.

Arthropods. Dried material will be much less attractive to motile pests than fresh material. With this sort of material an inspection can be carried out for motile pests. If a treatment has been applied offshore within a reasonable time span prior to importation, and acceptable documentation is provided, an inspection for arthropods alone is not justified.

Viruses. In general these are not thought to not remain viable within dried non viable material. But with material considered to be of a high value crop or of high value for other reasons, e.g. grapevine (Vitis) or hop (Humulus) material, a treatment given as a cautionary approach is considered wise, see also under seed paragraph.

Fungi. Viable material of a few fungal types may still be associated with dry plant material e.g. sporulating rusts, but the signs should be evident by inspection. As with the comment for viruses above, a precautionary treatment will be required for some high value material, see under seed paragraph.

Viable Fruits/mature seed heads/pods/capsules/seeds/fern spores. Reference to the PBI can be made to determine if a species is likely to be new to NZ, or if it has a prohibited status, or if there are likely to be plant health issues associated with seed e.g. many important grass species. Within some plant types that have quite insignificant small flowers, but attractive fruiting bodies or seed heads it can be difficult to determine if viable seeds are present e.g. sedges, rushes and grasses. Within such types where there is also a strong weed record, a precautionary treatment removes the risk. *Lagurus ovatus*, *Briza*, *Miscanthus* and other grasses listed as basic for seed in the PBI http://www1.MAFBNZ.govt.nz/cgi-bin/bioindex/bioindex.pl can be permitted with only inspection. Use of the PBI is also desirable to determine the genera which are regarded as economically important and within these those which if imported as fresh (i.e. nursery stock) have more stringent requirements for plant diseases, denoted by a L3 nursery stock requirement or option in the PBI (listed as L3 or L2,L3). While it is considered that virus diseases will not be an issue for dried material, and in general fungal diseases can be detected by inspection, it is considered wise, in the absence of full information about dried forms, to stipulate a precautionary treatment in case of undetected fungal contamination for all these genera. For example, pine needles and cones, whether fresh or dried, have been historically regarded as risk material based on their economic importance.

Viable material other than seeds. Any dried plant part material that is found on inspection to be dried to only a questionable degree should be given a treatment.

Dried fungi, mosses, lichens and seaweeds. As there is a high level of unknown risks a treatment is considered the best action. Viable material in such groups may be difficult to detect.

Dried ferns. References to the viability of stored spores show that some spores can remain viable for one or more years, although it is considered many loose viability within a short time in a dry atmosphere (Quintanilla et al 2002; Christina et al 2004). Assuming spores may be viable, a treatment

should be given where sporangia/spore presence is seen or suspected and the species would be new to NZ.

Dried palm material. Generally this comprises fronds/leaves with no fruits or seeds and is unlikely to have associated risks. Inspection should suffice as a suitable biosecurity measure.

5.4 Brushwood fencing, roofing and screening products

Brushwood fencing, roofing and screening panels have been imported into New Zealand for many years as commercial consignments. MAFBNZ has always required a precautionary treatment, regardless of progress towards inclusion in an import health standard. Products made from bamboo, willow and cane were included in the set of forestry import health standards developed in 2003. The emphasis with these standards was the mitigation of any pests considered likely to be associated with forestry and wood products. Depending on degrees of similarity of product and risk, fencing and roofing products made from other plant material could be placed either in this standard or in a wood products standard. It has been decided to group them together into a separate section in this plant products standard to reduce any inconsistencies with the treatment of these products.

The biosecurity risks are seen as low, but treatments are desirable because of the difficulties of inspection inherent with all large consignments and products of plant material already bound together into a finished product of this nature.

The scope of the section is for products that are known to be currently imported or have been previously requested. However, other similar products made from dried stems of other plant types intended for outdoor use as fencing, screening or roofing panels can be imported under the standard, provided they are given the longer 15 hour heat treatment, unless further assessed. This is the heat treatment mentioned in the above treatment section of15 hours at a minimum continuous core temperature of 85ºC at a relative humidity of 40%, as against the heat treatment option available for wood products: more than 4 hours at a minimum continuous core temperature of 70°C.
http://www.biosecurity.govt.nz/regs/imports/plants/forest
This latter treatment is more specifically applied for killing arthropods and devitalising fungi. But it is not considered sufficient for rendering all seeds non-viable, and has not been researched for the purpose of rendering stems unable to develop roots or shoots. Heat treatment is the only effective treatment available in NZ to devitalise seeds in a large consignment. The ISPM15 treatment rate of 56ºC for 30 minutes for wood packaging is considered not suitable for these products as a pre-export treatment intended to cover invertebrates and fungi on a precautionary basis, some of which do have a rough bark covering.

As with other plant products, treatments applied offshore will require the appropriate entries on the accompanying phytosanitary certificate. Inspection on arrival could be required when treatment is carried out offshore, but a level of trust in the documents is desirable.This may be up to the discretion of inspectors. Inspection may be carried out periodically to confirm the treatment was effective and check for feathers which may have been deposited after heat treatment.

Risks associated with arthropods and other mobile hitchhikers will vary a little between products and origins but their presence is considered a likely risk. No pest list is available for any of the products though, partly because:
- precautionary treatments have been applied rather than identification if any arthropods have been found;
- most records were entered only as “brushwood” rather than a particular type;
- the general policy with low risk products, as mentioned previously.

Records of the very few interceptions sent for identification, extracted from the Quancargo database between 2003 and 2008, show only the following 4 records, all from “brushwood” ex China, including post border reports:
- brushwood ex China, 1 adult Melangyna novaezelandiae, a NZ endemic hover fly

- brushwood ex China, 1 larva Coleoptera: Coccinellidae, not identified further
- brushwood ex China, 1 adult Ectopsocus vachoni, a new species of booklice
- brushwood ex China, 1 juvenile Steatoda grossa, comb footed house spider, non-regulated

Where there is considered a risk associated with any likelihood of stem propagability of the plant products, the plant product rate of heat treatment will eliminate the risk. The likelihood of presence of seeds is discussed within each type. Where these two risks are considered to be unlikely, there is a treatment option given of fumigation or heat treatment at the forest products rate should methyl bromide no longer be available.

There has been one report in an AQIS bulletin (March/April 2008) of brushwood stems sprouting shoots, but it is unknown what type of product was involved. The following is a discussion of brushwood products currently imported.

Thatch roofing panels/tiles imported from Africa and made from the following dried stems (without leaves or roots): Hyperthelia dissoluta (yellow thatching grass) family Poaceae, or reed stems of Thamnochortus insignis (Dekriet, thatching reed, Albertina thatching reed), family Restionaceae.

Seed heads and seed have been seen on *Thamnochortus insignis* product. The species would be new to NZ. The families Poaceae and Restionaceae are likely to have species of weed potential. Dried stems of these plants are not propagable. These products have been importer into NZ for over 12 years. Continuation of the current requirement of the 15 hour heat treatment is recommended. A permit has been issued in the past, but will no longer be required. Six consignments have been imported in last two years with no interceptions.

Brushwood fencing imported from China, made from dried stems of Baeckea frutescens (family Myrtaceae).

No seeds have been detected on this product. The species can be propagated by cuttings so if seeds were ever present or the stems sprouted and the species were to establish it would be new to NZ and any associated diseases could pose a risk to the endemic NZ Myrtaceae species. Continuation of the current requirement of the 15 hour heat treatment is recommended. A total of 119 consignments recorded as Brushwood ex China have been imported in the last two years, from which spiders were intercepted from two or three and two have required treatment following the find of feathers. If the feathers were present before heat treatment any risks would have been mitigated, but there is also a possibility the contamination was later. There was a post clearance anecdotal report of a spider.

Product from China made from Cunninghamia lanceolata family Taxodiaceae (also known as fir bark screening).

This product is thicker than fern or bamboo screening and has bark. The species can be propagated by cuttings and while not a new species to NZ, there would be risks with nursery stock, especially a conifer related to *Pinus*. The bark exfoliates in strips and could be a sheltering place for seed contamination or bark beetle infestations. Continuation of the current requirement of the 15 hour heat treatment is recommended. The number of consignments imported in last two years and interceptions is unknown exactly as these products have been included in Brushwood ex China generally.

Fern screening panels imported from China. These screening panels are made from the wire-like dried stems of genera such as Coniogramme, Dicranopteris, Gleichenia, Pteris and Pteridium.

It is not possible or necessary to be certain of the exact fern species involved, especially considering taxonomic variations. The product is one layer of dried stems wired, similar to bamboo screening. No fronds are involved. Even assuming there could be new species involved, there is no likelihood of stem propagability as propagation of these fern types is from division of rhizomes or from spores. The current requirements have been for the longer heat treatment. The proposed requirement is either methyl bromide at the rate suitable for arthropods or heat treatment for more than 4 hours at a minimum continuous core temperature of 70°C. The number of consignments imported in last two

years and interceptions is unknown exactly as these products have been included in Brushwood ex China generally.

Australian brushwood fencing made from plant stems (without leaves or roots) of Melaleuca uncinata (family Myrtaceae). Also known as broombrush.

The thickness of this product is usually about 12mm, sometimes 25mm but one different style product has been imported with stems of about 48mm. No seed heads or seeds have been detected, but the species would not be new to NZ. The risk of wind-blown contaminant seeds is considered no more likely than with many other plant products not treated for this possibility. *Melaleuca* can be propagated by half-ripe lateral shoots with a heel (RHS Dictionary), but the more usual method is from seed. For other information about *Melaleuca*, see:
http://www.avongro.com.au/Webpages/documents/GrowingBroombush.pdf
Stem propagability is not considered very likely because the stems will almost always be mounted within a timber frame, usually 150mm x 50mm, after importation and therefore will not be in contact with the soil. The risks should any stem sprout growth, would be similar to those of nursery stock of *Melaleuca uncinata*. However there is a possibility of a new species being introduced if the species is not *M. unicinata*.

The thick version of this product (around 48mm) will have associated bark. Fumigation will mitigate risks of arthropods, but not fungi. The thicker the stems, it could be argued that the closer the commodity comes to being regarded as a wood product that is not bark-free and should not enter NZ under the same requirements as most other bark-free wood products, but the bark of this product is reasonably smooth. Wood or stems greater than 30 mm in width may harbour wood boring insects and bark on wood may allow infestations of bark beetles to be present. The current requirement is treatment with methyl bromide at 240g for 24 hours, to mitigate arthropods and in the hope that this would render any stems unable to sprout. The proposed requirement is either methyl bromide at the rate suitable for arthropods or heat treatment for more than 4 hours at a minimum continuous core temperature of 70°C.

Between July 2006 and July 2008, 28 consignments (average consignment size is 28 pallets) have been imported. Over 600 tonnes of this fencing is imported annually.

No interceptions of arthropods have been made as all were fumigated with methyl bromide either offshore or on arrival. One interception of a mould was made in 1995, and anecdotally there have been others. This was identified as *Trichoderma viride*, a non-regulated fungus that assists in the decay of cellulose, known to commonly occur on wood. It was attributed to condensation forming at on the ceiling of the container.

Dried leaves of Alang-alang or Bali grass (Imperata cylindrica) as gazebo roof thatching from Indonesia.

There is no issue with propagability of dried grass leaves. Seed of *Imperata cylindrica* currently has a status of basic in the PBI, because regardless of being a known weed of concern, the species is not under control in NZ. The risks are other seed contamination and arthropods. Dried leaves that are bunched together are more of a risk and harder to inspect than a woven item of only one layer. The current requirement is inspection on arrival. Heat treatment for arthropods and inspection for seeds is now recommended. Only two consignments have been recorded in the last 2 years but others may have been recorded under another heading. One consignment was contaminated with seeds of *Cyprus* sp. and dead ants, the other had a fungal disease recorded. This product also has timber frame components packed separately which are imported under the wood standard products.

Other Brushwood/Screening Products

There are other products that may possibly be imported as fencing, panels, roof thatching or screening rolls e.g *Phragmites australis, Calluna vulgaris* and other reeds and grasses. These will be rendered

safe from the risks of propagability of new, regulated or prohibited species, or associated live organisms, if the 15 hour heat treatment is given.
For sample product illustrations see Appendix 5.

5.5 Miscellaneous dried or processed items for various other uses made from or including dried plant material

It is intended that the standard be as outcome based as possible to avoid many minor amendments. However, the prescriptive treatments listed for some of the items listed in this section are not likely to be altered and need to be listed this way, under the existing standards framework. Where possible commodities that are assessed to be of such low risk that no specific documentation or inspection is required, they will be added to the list "Approved processed plant product commodities" (see also under Certification on p. 4 above).

Dried Hops. The risks are not known for dry material, but hops are an economic crop. The preferred precautionary approach is to require heat treatment. If commercially packaged, pelletised, and compressed it is known that sufficient heat and pressure have been involved.

Only one historic interception record has been located for hops. The insect belonged to the genus *Macrosiphini* sp.

Dried Tobacco. Shredded, cut leaves, commercially packed for retail use are thought to be of very low risk. It is considered highly unlikely that this form of tobacco would be used for any other purpose or be exposed in any substantial way to the environment. Other forms e.g. uncut leaves are likely to be imported and the preferred precautionary approach is to heat treat.

From the very few interception records for tobacco/cigarettes/cigars the following insects are listed: *Lasioderma serricorne* (Cigarette beetle) and *Plodia interpunctella* (Indian meal moth).

Processed vegetable fibres (e.g. Palm fibres, Cotton (*Gossypium hirsutum*), Flax (*Linum usitatissimum*), Hemp (*Cannabis sativa*), Jute (*Corchorus* spp.), Ramie (*Boehmeria* nivea), Sisal (*Agave sisalana*))
Unprocessed vegetable fibres are not commonly imported commercially for direct use. If imported for further processing this is best handled in a TF under a permit. Most fibres have already been processed into mats, baskets, bags, hats and furniture woven parts, but some may be imported in a partially processed form ready for general uses e.g. balls or twine or fibre. Inspection is considered appropriate for risks associated with storage and transport.

Basket ware, Matting, Manufactured items woven including straw. (e.g. hats, and bags, furniture parts, frames made from Flax (*Linum usitatissumum* or *Phormium tenax*) (*Cannabis sativa*), Jute (*Corchorus* spp.), Ramie (*Boehmeria nivea*), Sisal (Agave sisalana), Palm leaves e.g. *Arenga* spp, Coconut (*Cocos nucifera*), Raffia (*Raphia* spp), Bassine (*Palmyra*, *Borassus* spp), Pandanus (*Pandanus* spp), *Corypha*, Water Hyacinth (*Eichhornia crassipes*), *Abaca* (Undersheath of *Musa textilis*), Seagrass.)

MAFBNZ Inspectors have reported that passenger carried flax hats, frequently imported as personal effects from the Pacific Islands, are seldom properly dried. Ceremonial flax mats from the Islands are usually imported privately as unaccompanied or accompanied baggage, rather than commercially. These mats can have ants and other live insect pests present and often need fumigation. They may also have undyed chicken feathers. Some handicrafts in baggage from the Islands (usually dried leaf picture frames) have been found to have insect holes in the leaf material and are treated as a precaution. For these reasons inspection of private consignments (mostly personal effects) of plant fibres and manufactured items derived from plant fibres is necessary.

Seagrass is a term that refers to flowering plants belonging to the following plant families and genera within these families (ICON):

Families and genera				
Zosteracea	Cymodoceacea	Hydrocharitaceae	Ruppiaceae	Zannichelliaceae
Alga	*Amphibolus*	*Anacharis*	*Udora*	*Althenia*
Heterozostera	*Cymodocea*	*Blyxa*		*Lepilaena*
Nanozostera	*Diplanthera*	*Dominia*		*Zannichellia*
Phyllospadix	*Halodule*	*Egeria*		
Zostera	*Pectinella*	*Elodea*		
	Syringodium	*Enhalus*		
	Thalassoderdron	*Halophila*		
		Hydrilla		
		Hydrocharis		
		Lagarosiphon		
		Maidenia		
		Najas		
		Ottelia		
		Schizotheca		
		Thalassia		
		Udora		
		Vallisneria		

Straw is a term used for a variety of dried cut stalks of grasses/cereals. As such there is a greater risk of associated fungal diseases than with the above fibres. However, over the last 20 years the visual cleanliness of the finished products generally has led to the decision that the fibres involved with these products are thought to be of very low biosecurity risk. Inspection is considered appropriate for these items for risks associated with storage and transport. Some products like many hats have also been through a heat moulding process in manufacture. Inspection is not required for these items in commercial consignments when the process is known.

Items made from maize and straw leaves are best heat treated if the fibres have not been bleached, dyed, heated or otherwise processed. In some instances e.g. single items through the mail, a 100% inspection could be carried out in lieu of a treatment.

Notably, a large number of items are dealt with as personal effects and were not formally recorded over the years. The following notes about data entries refer mostly to commercial consignments.

Data entries for “Mats” over the last 5 years show that of 458 listings specifically mentioning mats, 381 were from Tonga, many being Tapa mats. Others recorded as straw, flax or raffia comprise 20 from China, 19 from Vietnam and 23 from Samoa which also includes *Pandanus* mats. Entries from other countries are all less than 5. These entries exclude specifically erosion mats or table mats. Erosion matting can be of coir or straw products. The latter have always been heat treated in case of cereal diseases, regardless of the dry nature of the products.

Data entries for baskets or basket ware over the last 5 years show about 70% have originated from China, made from flax, straw or seagrass and about 28% from Australia, most entered as seagrass. The majority of fibre hats imported have been formed into shape under heat and are not inspected.

Many fibre based items are entered as handicrafts.

Broom millet
This category includes brooms and brush material ready for processing into brooms made from dried stems of *Sorghum* and other related grasses. Sorghum stems may occasionally have flower heads associated. As Sorghum grain has many associated plant diseases, it is considered appropriate to require a heat treatment for products not bleached. If it is known that no seed heads are present, an 8 hour heat treatment combined with an inspection for seeds is an option.

Items filled with plant material or seeds
The risks are very minimal, depending to some extent on the likelihood of the item tearing or being opened soon after importation. There is a risk of live insect infestation, reported from inspectors. If the list of ingredients shows a possibility of prohibited seeds being present or a high percentage of a regulated crop seed, a treatment to render non-viable is considered best, regardless of the risk of viable seed reducing over time. One exception that has been permitted is that of Lavender sprigs in closed pouches. A treatment will be required for loose (uncontained) Lavender seed or sprigs inspected and found to contain seeds, but in pouches/pillows the presence of seeds and the chances of seeds being infected with *Coniothyrium lavandulae* or *Phoma lavandulae* is considered a risk too low for concern.

Another area of exception is wheat packs manufactured in New Zealand or Australia, imported by passengers. Where it is accepted, based on verbal declaration from the importer, that the items have been used previously it is considered that the repeated microwaving will have devitalized the seeds .

Building panels
Ceiling or wall building panels containing straw or other plant fibres present little risk, especially if the straw is steamed first. Manufacturer's information about the processing with each consignment should be accepted. Specific branded products could be first imported under a permit with inspection and then later added to the approved processed products list.

Smudge sticks
Bundled vegetation (inc. grasses, conifers etc) bound with string for spiritual smoking use. These are ignited and allowed to smoulder. Smoke is claimed to have a beneficial effect. A treatment may be required if insects or insect damage is seen. Where there is a possibility of pathogens associated with grasses, coniferous material or unknown plant species a treatment will be required.

Corn Products
Products specifically made from *Zea mays* cobs require specific mention, because of the high economic value of the plant in NZ and high number of associated pests with the fresh material.

Corn dollies, dried corn husk items imported for ornamental use and unprocessed cob pieces (not fine grits) for coarse machine polishing material should be treated in case of any residual fungal agents.

Corn cobs with kernels, lacquered, for genetic teaching laboratories in universities and schools present no risk provided manufacturer's documentation declares the lacquering.

Other miscellaneous dried /processed products
Other items comprising non-viable plant material or derived from plants or plant material can be imported under this standard if the risks are first assessed e.g. *Lycopodium* spores as pollen diluents. Non-viable algae for processing or aquaculture feeding can also be included here, rather than under the animal feeds of plant origin standard. The animal related standard for fish food will specifically mention that it does not cover algae.

A few regularly imported products have been considered to be of no risk and are gathered in a final entry in the tabulation.

Pet litter and bedding

The few products historically imported for this purpose have been assessed by manufacturer's processing details and approved by MAFBNZ. These have generally been highly products derived from wood or clay. Name branded products can be included in the standard, as they are easily identified on document, commercially prepared, packaged ready for retail sale and have been initially inspected by MAFBNZ prior to approval. Further inspection is considered unnecessary. New pet litter and bedding products assessed and initially imported under a permit with inspection may be added to the standard when confirmed as satisfactory.

5.6 Dried foliage for research purposes

Dried Herbarium Specimens
The risks associated with viability of material have been addressed in the Environmental Risk Management Authority (ERMA) approval NOC002466. The risk of associated hitchhikers like storage pests is handled by the procedures followed by the containment facilities.

An import permit is used for confirmation and identity of the required containment facility and to provide a document to accompany consignments that will reduce any possible delays on arrival. If the documentation is not in accordance with the permit and ERMA approval, an inspection can be undertaken.

Dried plant material imported for all other laboratory testing, analysis and research, including DNA analysis.
This includes clean dried non-viable material for DNA analysis imported for identification purposes, which requires only a low level of post entry control through to diseased material where the intention is to study, propagate or carry out analyses on the disease, requiring a containment facility. All material must have a 100% inspection by an inspector of MAFBNZ on arrival in New Zealand unless stated otherwise on a permit for a particular purpose. In some cases it is not possible to be exactly sure of the risks associated with dried material, including when used in experimental environments where new molecular techniques could be employed. Having experimental material held in post entry control with required destruction at the finish of the project or testing and other appropriate controls removes the need to investigate risks in detail. It can also be desirable to allow for samples to be imported without official documentation that might otherwise be required and difficult to obtain in some circumstances. Having material directed to a containment or transitional facility is best accomplished by a permit.

Plant nucleic acids and Plant micro-organisms
These items should be imported under the MAFBNZ standards: Import Health Standard for the Importation of Biological Products into New Zealand and Import Health Standard for the Importation of Micro-organisms into New Zealand (just issued or under preparation).

5.7 Plant material preserved in alcohol and other preservatives
Plant material preserved in alcohol or other recognised preservatives. Plant material immersed in alcohol will generally render living organisms non-viable if not instantly, over a short period of time. No minimum strength is stipulated, but 70% is commonly used, and a recommended range is within 50 to 75%. With some seeds, however, a short immersion can increase germination before finally reducing it to zero. This may be due to faster softening or breakdown of some seed coats with alcohol. To allow safely for such a possibility, any seeds or fruits containing seeds should be immersed for at least 48 hours before clearance is given to be sure of complete inhibition. A declaration of content(s) issued by a recognised institution or government department stating the date of immersion in the alcohol should accompany the material to verify the period of immersion.

Microscope slides of plant tissue (including micro-organisms fixed onto glass microscope slides and sealed under glass cover slips) are considered to present no risk.

6. SUMMARY

MAFBNZ encourages an outcome of imported clean products that are entirely free of pests and contaminants. The draft import health standard outlines the requirements for dried and preserved plant products that are not listed in other import health standards. Suitable biosecurity measures are an appropriate combination of inspections, treatments, documentation, permits and post entry control in transitional facilities. Distinction between accompanied goods and unaccompanied will be made where considered necessary.

Import requirements have been separated into 7 major product/use groupings, and further separated into groupings depending on their perceived biosecurity risk. A permit to import will be required for specific products which MAFBNZ must assess on a case-by-case basis. Approved processed products will be added to the IHS to allow for importation of products approved by MAFBNZ to be of minimal biosecurity risk.

REFERENCES:

AsureQuality New Zealand (2002) Devitalising seed contaminants using methyl bromide. Unpublished report.

Australian Quarantine and Inspection Service import conditions database (ICON database):

Biosecurity Australia (2002) Import Risk Analysis for the Importation of bulk maize (*Zea mays* L.) from the United States of America. Biosecurity Australia, Canberra.

Biosecurity Australia (BA) & Australian Quarantine and Inspection Service (AQIS) (2003) Biological Dossier on Dried Australian Flowers and Foliage for Export, Lim K. & Saverimuttu N.

Bromide Compounds Ltd. Methyl bromide soil fumigation: Use and application.

Bullians, M. S., Alison V., and Sarty M. (2009) *NZ Plant Protection Society Journal*. Methyl Bromide Funigation of weed seeds in compressed coco peat (submitted for publication).

Cassells, J., Collins, P.J. & Banks, H.J. (1995). Devitalisation of maize and sorghum by methyl bromide and chloropicrin. *CSIRO Division of Entomology Technical Report No. 61*.

Christina F., Pangua A, Pangua E (2004). Spore Viability Under Different Storage Conditions in Four Rupicolous Asplenium L. Taxa. *American Fern Journal 94(1): 28-38*

Fields, P.G. (1992) The control of stored product insects and mites with extreme temperatures. *Journal of Stored Products Research* 28(2): 89-118.

MAFBNZBNZ Risk Analysis notes for dyeing, bleaching and freeze drying (2009), discussion of literature and references (the conclusions from this work are incorporated into these discussion notes for the standard) – available on request.

MAFBNZBNZ Treatment Standard (2008) Approved Biosecurity treatments for risk goods directed for treatment BNZ-STD-ABTRT. MAFBNZ Biosecurity New Zealand, Wellington. http://www.biosecurity.govt.nz/files/regs/stds/bnz-std-abtrt.pdf

Marsh, Wilkins, Wynn-Williams/Canensis (2005) Evaluation of Irradiation as a Phytosanitary Treatment (held on MAFBNZ files).

Quintanilla L. G., Amigo J., Pangua E., Pajaron S. (2002) Effect of Storage Method on Spore Viability in Five Globally Threatened Fern Species. *Annals of Botany 90(4): 461-467.*

Royal Horticultura Society Dictionary Dictionary of Gardening (RHS Dictionary) (1992).

APPENDIX 1:

Commonly used plant pieces (cut herbs) imported for Further Processing by name, scientific name (common name) and dried part of plant used (usually fine cut or powdered)

Achillea millefolium (Yarrow); Whole plant
Achyranthes spp (Chaff-flower); Roots
Adhatoda vasica (Adhatoda) See Justicia adhatoda
Aesculus hippocastanum (Horse chestnut); Seed
Agrimonia eupatoria (Agrimony); Leaves
Agropyron repens (Couch); Roots
Albizzia lebbeck (Albizzia); Bark, Seed
Alchemilla vulgaris (Lady's mantle); Whole plant
Aletris farinosa (Unicorn); Roots
Alisma spp (Water Plantain); Roots
Allium sativa (Garlic); Roots
Althaea officinalis (Marshmallow); Roots
Andrographis paniculata (Andrographis); Whole plant
Angelica gigas or *archangelica* (Angelica); Roots
Angelica sinensis (Dong quai); Roots
Apium graveolens (Celery seed); Seed
Arctium lappa (Burdock); Roots
Arctostaphylos uva-ursi (Bearberry); Leaves
Armoracia rusticana (Horse radish); Roots
Arnica montana (Arnica); Flowers
Artemisia absinthium (Wormwood); Whole plant
Artemisia annua (Qing Hao); Whole plant
Artemisa vulgaris (Mugwort); Whole plant
Asclepias tuberosa (Pleurisy Root); Roots
Asparagus racemosa (Shatavari); Roots
Astragalus membranaceous (Astragalus); Roots
Atractylodes macrocephalae (Atractylodes or oat); Roots
Avena sativa (oat); Whole plant
Bacopa monniera (Bacopa); Whole plant
Ballota nigra (Black Horehound); Whole plant
Baptisia tinctora (Baptisia); Roots
Barosma betulina (Buchu); Leaves
Berberis aristata (Indian Barberry); Bark
Berberis vulgaris (Barberry); Bark
Biota orientalis See *Platycladus orientalis*
Bupleurum falcatum (Bupleurum); Roots
Calendula officinalis (Calendula); Flowers
Chamaelirum luteum (False unicorn root); Roots
Capsella bursa-pastoris (Shepherds purse); Whole plant
Capsicum minimum (=*Capsicum fruitescens*) (Cayenne) ; Fruit
Caulophyllum thalictroides (Blue Cohosh); Roots
Centella asiatica (Gotu Kola); Whole plant
Chelidonium majus (Greater Celandine); Whole plant
Cimifuga racemosa (Black Cohosh); Roots
Cinnamomum zeylanicum (Cinnamon); Bark
Cnicus benedictus (Holy thistle); Whole plant
Cocos nucifera (Coconut); Ground coconut shell
Codonopsis pilosula (Codonopsis); Roots
Cola nitida (Kola nut); Nuts
Coleus forskohlii (Coleus); Roots
Collinsonia canadensis (Stoneroot); Roots
Commiphora molmol (Myrrh) ; Resin

Corydalis ambigua (Corydalis); Roots
Crataegus monogyna (Hawthorn); Fruit
Crataeva nurvala (Crataeva); Roots, bark
Curcuma longa (Turmeric); Roots
Cyanara scolymus (Globe Artichoke); Whole plant
Cynodon dactylon (Couch grass); Roots
Dioscorea villosa (Wild Yam); Roots
Echinacea angustifolia (Echinacea); Roots
Echinacea purpurea (Echinacea); Roots
Eleutherococcus senticosus (Siberian ginseng); Roots
Epilobium parviflorum (Willow herb); Whole plant
Equisetum arvense (Horsetail); Whole plant
Eschscholtzia californica (Californian Poppy); Whole plant
Eugenia caryophyllus (Clove); Flowers
Eupatorium perfoliatum (Boneset); Whole plant
Eupatorium purpureum (Gravelroot); Roots
Euphorbia hirta (Euphorbia); Whole plant
Euphrasia officinalis (Eyebright); Whole plant
Filipendula ulmaria (Meadowsweet); Whole plant
Foeniculum vulgare (Fennel); Seeds
Fucus vesiculosus (Bladderwrack seaweed); Whole plant
Galega officinale (Goats Rue); Aerial parts
Galium aparine (Cleavers); Whole plant
Gentiana lutea (Gentian); Roots
Geranium maculatum (Cranesbill); Roots
Ginkgo biloba (Ginkgo); Leaves
Glycyrrhiza glabra (Liquorice); Roots
Grindelia camporum (Grindelia); Whole plant
Gymnema sylvestre (Gymnema); Whole plant
Hamamelis virginica (Witchhazel); Leaves
Harpagophytum procumbens (Devils Claw); Roots
Hedera helix (Ivy); Leaves
Hemidesmus indicus (Hemidesmus); Roots
Hibiscus sabdariffa (Roselle); Flowers
Humulus lupulus (Hops); Catkins (strobiles)
Hydrastis canadensis (Golden seal); Roots
Hypericum perforatum (St. John's Wort); Whole plant
Hyssopus officinalis (Hyssop); Whole plant
Inula helenium (Elecampane); Roots
Iris versicolor (Blue flag); Roots
Juglans nigra (Black Walnut); Leaves, Green hulls (fruit rind)
Juniperus communis (Juniper); Berries
Justicia adhatoda (Adhatoda); Leaves
Lactuca virosa (wild lettuce); Whole plant
Lamium album (White deadnettle); Whole plant
Lavandula officinalis (Lavender); Flowers
Leonurus cardiaca (Motherwort); Whole plant
Lindera spp (Spice bush); Roots
Lycopus virginicus (Bugleweed); Whole plant
Lycium barbarum (Lycium); Fruit
Mahonia aquifolium (Oregon Grape); Roots
Marrubium vulgare (White Horehound); Whole plant
Matricaria recutita (Chamomile); Flowers
Medicago sativa (Alfalfa); Whole plant
Melissa officinalis (Lemon balm); Whole plant
Mentha piperita (Peppermint); Whole plant
Menyanthes trifoliata (Bogbean); Whole plant

Mitchella repens (Squaw Vine); Whole plant
Myrica cerifera (Bayberry); Bark
Nepeta cataria (Catnip); Whole plant
Olea europea (Olive); Leaves
Origanum dictamnus (Dittany of Crete); Leaves
Paeonia lactiflora (Peony); Roots
Panax ginseng or *quinquifolium* (Ginseng); Roots
Panax notoginseng (Tienchi ginseng); Roots
Passiflora incarnata (Passionflower); Leaves
Peumus boldo (Boldo); Leaves
Phyllanthus amarus (Phyllanthus); Whole plant
Phytolacca decandra (Poke); Roots
Picrorrhiza kurroa (Katuka); Roots
Pimpinella anisum (Aniseed); Fruit or seed
Piper methysticum (Kava); Roots
Pistacia erythrina Jamaican Dogwood); Stem, bark
Plantago lanceolata (Ribwort, Plantain); Aerial parts
Platycladus orientalis (Oriental thuja or Chinese arborvitae); Foliage
Pogostemon patchouli (Dilem); Leaves
Polygala tenuifolia (Polygala); Roots
Polygonum multiflorum (Polygonum); Roots
Poria cocos (Poria); Mycelium
Prunus serotina (White Cherry); Bark
Pueraria spp (Kudzu); Roots
Quercus robur (Oak);Bark
Rehmania glutinosa (Rehmania); Roots
Rhamnus purshiana (Cascara); Bark
Rheum officinale (Rhubarb); Roots
Rhodiola rosea (Rhodiola); Roots
Rosa x *damascene* (Rose); Leaves
Rosa (Rose hip); Fruits, seeds
Rosmarinus officinalis (Rosemary); Whole plant
Rubus idaeas (Raspberry); Whole plant
Rumex crispus (Yellow Dock); Roots
Ruta graveolens (Rue); Whole plant
Salix alba (Willow); Bark
Salvia miltorrhiza (Dan shen); Roots
Salvia officinalis (Sage); Whole plant
Sambucus nigra (Elderberry); Roots
Schizandra chinensis (Schisandra); Fruit
Scrophularia nodosa (Figwort); Whole plant
Scutellaria baicalensis (Scullcap); Whole plant, roots
Serenoa repens (= *S. serrulata*) (Saw Palmetto); Fruit
Silybum marianum (Milk thistle); Seeds
Smilax spp (Sarsaparilla); Roots
Solidago virgaurea (Golden rod); Whole plant
Stachys officinalis (Wood Betony); Whole plant
Stellaria media (Chickweed); Whole plant
Symphytum officinale (Comfrey); Leaves and root
Tabebuia impetiginosa (syn. *T. avellanedae*) (Pau D'Arco); Bark
Tanacetum parthenium (Feverfew); Leaves
Tanacetum vulgare (Tansy); Aerial parts
Taraxacum offinicalis (Dandelion); Roots and Leaves
Thuja occidentalis (White cedar); Aerial parts
Thymus vulgaris or *serpyllum* (Thyme); Whole plant
Tilia spp (Lime); Flowers
Tribulus terrestris (Puncturevine); Seed

Trifolium pratense (Red clover); Flowers
Trigonella foenum –graecum (Fenugreek); Seeds
Trillium erectum (Bethroot); Roots
Tropaeolum majus (Nasturtium); Whole plant
Turnera diffusa var.*aphrodisiaca* (Damiana); Whole plant
Tussilago farfara (Coltsfoot); Flowers, leaves
Ulmus fulva (Slippery elm); Bark
Uncaria tomentosa (Cats Claw); Bark, roots
Urtica dioica (Perennial nettle); Whole plant or leaves
Vaccinium myrtillus (Bilberry); Berries
Valeriana officinalis (Valerian); Roots
Vanilla planifolia (Vanilla); Seed
Verbascum thapsus (Mullein); Leaves/flowers
Verbena officinalis (Vervain); Whole plant
Viburnum opulus (Cramp bark); Bark
Viburnum prunifolium (Black Haw); Bark
Vinca minor (Lesser periwinkle); Whole plant
Viola odorata (Violet); Whole plant
Viola tricolor (Heartsease); Whole plant
Vitex agnus-castus (Chaste berry); Fruit
Viscum album (Mistletoe); Whole plant
Withania somnifera (Ashwagandha); Roots
Zanthoxylum americanum or *clava-herculis* (Prickly Ash); Bark
Zea mays (Cornsilk, corn); Stigmas, Whole plant
Zingiber officinale (Ginger); Roots
Ziziyphus jujuba var. *spinosa* (Zizyphus); Seed
Ziziphus spinosus; Seed

APPENDIX 2:

Examples of genera and species commonly used as flowers and plant parts for ornamental purposes.

Abelmoschus esculentus (Okra)
Acacia spp
Acer spp (Maple)
Achillea spp (Yarrow)
Aconitum napellus (Monkshood)
Actinotus helianthi (Flannel flower)
Adenthos (Jugflower)
Agonis spp (Myrtle)
Agrostemma githago (Corn-Cockle)
Aira spp (Silver hairgrass)
Alcea rosea (Althaea, Hollyhock)
Alchemilla mollis (Lady's Mantle)
Allium spp (Onion)
Alyssum spp
Amaranthus (Cat tail)
Ammobium alatum (Winged everlasting)
Ammophila arenaria (Marram grass)
Anaphalis spp (Pearly everlasting)
Andersonia caerulea
Anemone spp
Anethum graveolens (Dill)
Anigozanthos spp (Kangaroo paw)
Anthemis spp (Chamomile)
Aphyllanthes spp
Arctotis spp
Armeria spp
Artemisia (Wormwood)
Arundinaria gigantean (Giant reed)
Astilbe spp
Avena sativa (Oat)
Banksia spp
Bariza spp
Beaufortia spp
Bellis perennis (Lawn daisy)
Betula pendula (Birch)
Borassus flabellifer (Palmyra Palm)
Boronia heterophylla
Briza maxima (Quaking grass)
Bromus spp (Brome grasses)
Buxus sempervirans (Boxwood)
Calamus rotang (Rattan palm)
Calendula spp (Pot marigold)
Callistemon spp (Bottlebrush)
Capsicum spp (Peppers)
Carex spp (Sedges)
Carlina spp (Carline thistle)
Carthamus tinctorius (Safflower)
Caustis dioica (Chinese puzzle sedge)
Caustis recurvata
Celastrus spp
Celosia spp (Cockscomb)
Chammaemelum nobile Chamomile)
Chasmanthium latifolium (Sea oats)
Choisya ternate (Mexican orange blossom)
Chrysanthemum parthenium (Feverfew)
Chrysocephalum apiculatum (Everlasting)
Clematis tangutica
Cladium angustifolium
Cocos nucifera (Coconut)
Conospermum spp
Consolida spp
Corymbia calophylla (Port Gregory Gum)
Cotinus coggyria (Smoketree)
Craspedia spp (Woollyheads)
Cymbidium spp
Cynara cardunculus (Cardoon)
Cyperus papyrus (Paper sedge)
Cytisus scoparius (Common broom)
Dahlia spp
Daviesia cordata (Bookleaf)
Delphinium spp (Larkspur)
Dendranthema spp (Chrysanthemum)
Dianthus caryophyllus (Carnation)
Dipsacus spp (Teasels)
Dryandra spp
Dryopteris filix-mas (Male fern)
Echinops ritro (Blue Globe Thistle)
Elephantopus mollis (Tobacco weed)
Erica cinerea (Bell heather)
Eryngium planum (Sea holly)
Eucalyptus spp (Gum)
Fagus spp (Beech)
Fern fronds
Festuca spp (Fescue grasses)
Galeopsis angustifolium (Hemp-nettle)
Gaultheria shallon (Salal)
Gomphrena globosa (Globe Amaranth)
Goniolimon tataricum (German statice)
Grevillea spp
Gypsophila spp (Baby's breath)
Hakea spp
Hedera helix (Ivy)
Helianthus annuus (Sun flower)
Helichrysum bracteum (Strawflower)
Helipterum spp (Everlasting daisy)
Hordeum vulgare (Barley)
Hydrangea macrophylla
Hibiscus sabdariffa (Roselle)
Humulus lupulus (Hops)
Iberis umbellate (Globe candytuft)
Iris spp
Ixodia achilleoides
Juncus spp (Rushes)
Lachnostachys eriobotrya

Lachnostachys verbascifolia
Lagenaria siceraria (Calabash, African bottle gourd)
Lagurus ovatus (Hare's tail)
Lamarkia aurea (Golden top grass)
Lapsana communis (Nipplewort)
Lavandula (Lavender)
Leptospermum spp (Tea tree)
Leucodendron spp
Leucopogon verticillatus (Tassel flower)
Lecythis usitata, nuts
Liatris spp (Blazing star)
Lichen, dried
Lilium spp
Limonium bellidifolium
Limonium latifolium (Sea Lavender)
Limonium sinuatum (Statice)
Linum usitatissimum (flax)
Lomandra spp (Mat rushes)
Lonas inodora (Lona)
Lunaria spp (Honesty)
Lychnis spp
Lysinema ciliatum (Curry flower)
Matricaria recutica (Chamomile)
Meeboldina scariosa (Velvet rush)
Micromrytus ciliata
Miscanthus sinensis (Maiden grass)
Molucella laevis (Bells of Ireland)
Moss
Nelumbo nucifera (Lotus)
Nigella spp (Love in the mist)
Origanum laevigatum (Oregano)
Ozothamnus diosmifolius (Pink rice flower)
Paeonia spp
Panicum miliaceum (Broomcorn millet)
Papaver spp (Poppy)
Pennisetum glaucum (Pearl millet)
Persoonia longifolia
Phaenocoma spp
Phalaris arundinacea (Reed canarygrass)
Phalaris canariensis (Annual canarygrass)
Phleum pratense (Timothy grass)
Phlomis spp
Phragmites australis (Common reed)
Physalis alkekengi (Chinese lantern)
Pinus sylvestris
Pithocarpa corymbulosa
Plagianthus spp (Ribbonwood)
Protea spp Pink Ice
Ptilotus spp
Quercus spp (Oak)
Ranunculus spp (Buttercups)
Reseda lutea (Wild Mignonette)
Rhodanthe chlorocephala (Straw flowers)
Rosa spp (Rose)
Rudbeckia spp (Coneflower)
Rumex spp (Docks and sorrels)
Salvia farinacea (Blue Salvia)
Scabiosa stellata (Star scabious)
Selaginella lepidophylla (Resurrection plant)
Selaginella spp (Club mosses)
Sesamum indicum (Sesame)
Setaria macrochaeta (Green millet)
Setaria verticillata (Hooked bristlegrass)
Schinus molle (Peruvian pepper tree)
Scirpus spp (Club-rushes)
Silene latifolia (White campion)
Solidago spp (Goldenrods)
Sphagnum, moss
Stachys byzantina (Lamb's ear)
Stirlingia latifolia (Blue boy)
Tagetes patula (Marigold)
Tanacetum parthenium (Feverfew)
Templetonia retusa
Thryptomene denticulata
Tilia spp (Linden)
Tillandsia usneoides (Spanish moss)
Tragopogon spp
Triticum (wheat)
Typha spp (Bulrush)
Uniola spp
Verbascum spp (Mullein)
Verbena spp
Verticordia brownii
Verticordia nitens
Waitzia spp
Xanthorrhoea australis (Black Boy)
Xeranthemum annuum (Everlasting)
Xerochrysum bracteatum (Strawflower)
Xylomelum angustifolium (Woody pear)
Xylomelum occidentale
Zea mays (maize)
Zinnia elegans

APPENDIX 3:

Summary of live genera/species recorded in identification data
(Records from 1988 to April 2009.)

Pest Taxonomy	Pest Scientific Name	Regulatory status if determined	Recorded Hosts and Countries of Origin
Mites & spiders	Arachnida		
Acarina: Phytoseiidae	*Amblyseius sp.*		Basketware; Niue
Araneae: Dysderidae	*Dysdera crocata*		Sacking navigation bag; Fiji
Araneae: Lamponidae	*Lampona sp.*		Floor mat; USA
Acarina: Acaridae	*Lardoglyphus konoi*		Dried Lotus leaf; HONG KONG
Araneae: Araneidae	*Metepeira sp.*		Freight bag; USA
Acarina: Tetranychidae	*Oligonychus sp.*		Conifer twigs; Unknown country
Acarina: Ascidae	*Proctolaelaps pygmaeus* (Acarid mite)	Non-regulated	Pine Bark; Japan
Araneae: Theridiidae	*Steatoda sp.*		Bag; USA
Actinedida: Tetranychidae	*Tetranychus sp.* (Schoenei spider mite)		Dried Citrus leaves, medicinal leaves; Samoa and Tonga
Insects	*Insecta*		
Coleoptera: Scarabaeidae	*Adoretus sp.*		Basketware; Samoa
Lepidoptera: Noctuidae	*Agrotis sp.*(Cutworm)		Straw matting; China
Coleoptera: Silvanidae	*Ahasverus advena* (Foreign grain beetle)	Non-regulated	Buri matting; Philippines Medicinal herbs; Taiwan
Coleoptera: Scarabaeidae	*Anomala sp.*(Scarab beetle)		Pot pourri; China
Hymenoptera: Formicidae	*Anoplolepis gracilipes* (Yellow crazy and)	Regulated	Medicinal Palm Oil Extract; Malaysia
Coleoptera: Dermestidae	*Anthrenus sp.*		Basket; Zimbabwe
Coleoptera: Dermestidae	*Apsectus sp.*		Flax; Indonesia
Coleoptera: Anthribidae	*Araecerus fasciculatus* (Coffee bean weevil)	Regulated	Chinese herbal medicine; China and Singapore
Coleoptera: Staphylinidae	*Atheta coriaria*		Hay/straw; Netherlands
Coleoptera: Dermestidae	*Attagenus fasciatus* (Warehouse beetle)	Regulated	Herbal medicine; China
Coleoptera: Dermestidae	*Attagenus sp.*		Herbal medicine; Singapore
Hemiptera: Pseudococcidae	*Balanococcus diminutus*		Flax; USA
Blattodea: Blattellidae	*Blattella germanica* (German cockroach)	Non-regulated	Dried flowers; Australia
Lepidoptera: Pyralidae	*Cadra cautella* (Tropical warehouse moth)	Non-regulated	Chinese medicine, dried flower, dried ginseng roots; AUSTRALIA, CHINA, KOREA, MALAYSIA, SINGAPORE, TAIWAN
Hymenoptera: Formicidae	*Camponotus sp.* (Carpenter ant)		Basketware; Australia, India
Coleoptera: Nitidulidae	*Carpophilus sp.* (Sap Beetles)		Dried ginseng; TAIWAN

Hemiptera: Coccidae	*Coccus sp.*		Flax; Tonga
Coleoptera: Cucujidae	*Cryptolestes pusilloides* (Flat grain beetle)	Non-regulated	Ginseng and herbal medicine; Hong Kong
Coleoptera: Tenebrionidae	*Cryptolestes sp nr turcicus*		Medicines; China
Coleoptera: Silvanidae	*Cryptolestes sp.* (Grain beetle)		Basketware; Niue
Coleoptera: Cryptophagidae	*Cryptophagus sp.* (Cryptophagid fungal beetle)		Dried straw samples; Australia
Lepidoptera: Tortricidae	*Cydia pomonella* (Codling moth)	Non-regulated	Cork placemat; Unknown country
Hemiptera: Miridae	*Cyrtorhinus sp.* (Plant bug)		Dried leaves with fungus; Indonesia
Coleoptera: Dermestidae	*Dermestes maculates* (Hide beetle)	Non-regulated	Chinese medicine, Dried lotus leaves, rolled leaf cigarettes; Cambodia, China, Hong Kong,
Coleoptera: Anthribidae	*Doticus palmaris*		Dried plant material; Australia
Psocoptera: Ectopsocidae	*Ectopsocus briggsi* (Psocid)	Non-regulated	Buri matting; Philippines
Lepidoptera: Pyralidae	*Ephestia elutella* (Tobacco moth)	Non-regulated	Dried wild flowers, ginseng root; Australia, china
Lepidoptera: Pyralidae	*Ephestia figulilella* (Raisin moth)	Regulated	Dried plant material; China
Lepidoptera: Pyralidae	*Ephestia kuehniella* (Mediterranean flour moth)	Non-regulated	Dried flowers; AUSTRALIA
Lepidoptera: Pyralidae	*Ephestia sp.*		Chinese herbs, medicinal roots; China, Philippines
Orthoptera: Gryllidae	*Gryllus sp.* (Crickets)		Straw packing; India
Lepidoptera: Noctuidae	*Heliothis sp.* (Budworms)		Dried Lilac flowers; Australia
Insecta: Lepidoptera: Oecophoridae	*Hofmannophila pseudospretella*	Non-regulated	Dried cereals and flower heads; UK
Insecta: Coleoptera: Anobiidae	*Lasioderma serricorne* (Cigarette beetle)	Non-regulated	Chinese herbs, cigarettes, Cigars, Coffee seeds, dried cabbage, dried Chrysanthemum flowers, dried leaves, ginseng root, medicinal leaves/roots, pot pourri, reed basket, dried rose buds, sacking basket, tobacco; Asia, China, Hong Kong, Indonesia, Malaysia, PNG, Philippines, Singapore; Taiwan, UK, USA, Vietnam
Insecta: Coleoptera: Trogossitidae	*Lophocateres pusillus* (Siamese grain beetle)	Regulated	Dried flower buds; China
Insecta: Coleoptera: Lathridiidae	*Microgramme sp*		Medicinal herbs; Taiwan
Insecta: Coleoptera: Silvanidae	*Monanus concinnulus* (Flat bark beetle)	Regulated	Dried plant material; Niue
Insecta: Hymenoptera: Formicidae	*Monomorium floricola* (Ant)	Regulated	Sugar cane; Fiji
Insecta: Hymenoptera: Formicidae	*Monomorium pharaonis* (Pharaoh ant)	Non-regulated	Chinese medicine; Bangladesh; China
Insecta: Hymenoptera: Formicidae	*Monomorium sp.* (Ants)		Basketware, Chillie leaves; Indonesia, Tonga
Coleoptera: Cerylonidae	*Murmidius ovalis*		Herbal medicine; China
Hemiptera: Aphididae	*Myzus sp.*		Medicine and Chillie leaves; Tonga
Coleoptera: Cleridae	*Necrobia sp*		Dried flowers; Egypt
Hemiptera: Diaspididae	*Oceanaspidiotus pangoensis*	Regulated	Medicinal leaves; Samoa
Coleoptera: Silvanidae	*Oryzaephilus Mercator*	Non-regulated	Herbs and leaves; PNG

	(Merchant grain beetle)		
Coleoptera: Silvanidae	*Oryzaephilus surinamensis* (Sawtoothed grain beetle)	Non-regulated	Chinese medicine, Ginseng, sacking; China, Hong Kong, Korea, Sth Africa
Lepidoptera: Pyralidae	*Aramyelois transitella* (Navel Orangeworm)	Regulated	Ginseng; USA
Hymenoptera: Formicidae	*Pheidole megacephala* (Bigheaded ant)	Non-regulated	Medicinal bark and leaves; Samoa, Tonga
Hymenoptera: Formicidae	*Pheidole sp.* (Large-headed ant)	Regulated	Cocoa pods, medicinal leaves; Samoa, Tonga, India
Lepidoptera: Pyralidae	*Plodia interpunctella* (India meal moth)	Non-regulated	Dried plant material/medicines, Coffee seeds, dried Marigold flowers, dried seaweed, felt and straw hat, ginseng, tree nut necklace, pot pourri; AUSTRALIA, CHINA, EGYPT, HONG KONG, INDIA, INDONESIA, JAPAN, KOREA, SWITZERLAND, TAIWAN
Coleoptera: Bostrichidae	*Rhyzopertha dominica* (Lesser grain borer)	Non-regulated	Medicines, toy with wheat; Australia, Hong Kong
Coleoptera: Silvanidae	*Silvanus bidentatus*	Regulated	Sugar cane; Fiji
Coleoptera: Curculionidae	*Sitophilus granarius* (Granary weevil)	Non-regulated	Soft toy filled with wheat; Unknown country
Coleoptera: Curculionidae	*Sitophilus oryzae* (Rice weevil)	Non-regulated	Chinese herbs, mail bags; China, Hong Kong
Coleoptera: Curculionidae	*Sitophilus sp.*		Ginseng; China
Coleoptera: Curculionidae	*Sitophilus zeamais* (Maize weevil)	Non-regulated	Mail bags, herbal medicine; China, Hong Kong
Coleoptera: Anobiidae	*Stegobium paniceum* (Drugstore beetle)	Non-regulated	Dried flowers, ginseng, medicinal herbs; Australia, China, Hong Kong, Sri Lanka
Hymenoptera: Formicidae	*Tapinoma melanocephalum* (Ghost ant)	Regulated	Sraw, medicinal leaves; Samoa and Tonga
Coleoptera: Ostomidae	*Tenebroides mauritanicus* (Cadelle)	Non-regullated	Herbal medicine; China
Coleoptera: Cleridae	*Thaneroclerus buqueti*		Herbal medicine; China, Hong Kong
Insecta: Coleoptera: Tenebrionidae	*Tribolium castaneum* (Red flour beetle)	Non-regulated	Ginseng, Medicine; China, Indonesia
Insecta: Coleoptera: Dermestidae	*Trogoderma glabrum* (kharpra beetle)	Regulated	Herbal medicine; China
Insecta: Hymenoptera: Vespidae	*Vespula germanica* (German wasp)	Non-regulated	Medical supplies; Germany
Insecta: Hymenoptera: Anthrophoridae	*Xylocopa sp.*		Herbal medicine; Malaysia
Reptiles	*Reptilia*		
Squamata: Scincidae	*Eutropis sp.*		Plant fibres woven bag; Vietnam
Fungi			
Ascomycetes: Pleosporales: Pleosporaceae	*Alternaria sp.* (leaf spot)		Dried Citrus leaves; Papua New Guinea
Ascomycetes: Incertae sedis: Apiosporaceae	*Arthrinium sp.*		Flax; Samoa
Ascomycetes: Eurotiales: Trichocomaceae	*Aspergillus niger* (black mould)	Non-regulated	Tobacco; Tanzania
Ascomycetes: Eurotiales: Trichocomaceae	*Aspergillus sp.* (Aspergillus rot)		Yellow dock leaves; INDIA
Ascomycetes: Pleosporales: Pleosporaceae	*Cochliobolus sativus* (leaf spot)	Non-regulated	Dried grass research sample; Portugal

Zygomycetes: Mucorales: Mucoraceae	*Mucor sp.*		Herbal medicine; India
Ascomycetes: Trichosphaeriales: Incertae sedis	*Nigrospora sphaerica* (squirter disease)	Non-regulated	Herbal Aconitum; UK
Ascomycetes: Eurotiales: Trichocomaceae	*Paecilomyces variotii*	Non-regulated	Pine Bark; Japan
Ascomycetes: Eurotiales: Trichocomaceae	*Penicillium sp.*		Tobacco; Tanzania
Ascomycetes: Xylariales: Amphisphaeriaceae	*Pestalotia sp.*		Flax; Samoa
Ascomycetes: Diaporthales: Valsaceae	*Phomopsis sp.* (rot)		Flax; Samoa
Ascomycetes:	*Sordaria fimicola* (dung fungus)	Non-regulated	Tobacco; Brazil
Ascomycetes: Hypocreales: Hypocreaceae	*Trichoderma viride*		Pine bark; Japan
Zygomycetes: Mucorales: Mucoraceae	*Mucor sp.*		Herbal medicine; India
Seeds			
Malvaceae	*Hibiscus esculentus*		Pot pourri; Australia
Poaceae	*Avena sativa*		Dried cereals and flower head; UK
Sterculiaceae	*Cola acuminate*		Sacking pay bag; Nigeria
Ranunculaceae	*Delphinium sp.*		Dried cereals and flower head; UK
Arecaceae	*Elaeis guineerisis*		Pot Pourri; Australia
Rubiaceae	*Galium aparine*		Plantain leaves; USA
Malvaceae	*Gossypium sp.*		Cotton balls; USA
Lamiaceae	*Lavandula sp.*		Dried cereals and flower heads; UK
Poaceae	*Lolium sp.*		Plantain leaves; USA
Poaceae	*Oryza sativa*		Straw packaging; China
Papaveraceae	*Papaver sp.*		Dried cereals and flower heads; UK
Solanaceae	*Physalis alkekengi*		Dried arrangement; UK
Cyperaceae	*Scirpus sp.*		Pot Pourri; Australia
Poaceae	*Triticum aestivum*		Dried cereals and flowerheads; UK
Fabaceae	*Vicia sp.*		Plantain leaves; USA
Poaceae	*Avena sativa*		Dried cereals and flower head; UK

APPENDIX 4:

Review of dyeing, bleaching and freeze drying treatments

Dyeing, bleaching and freeze-drying are practises that may be used in the manufacture of dried plant products. The following assessments have been made to determine whether these treatments can help mitigate the risks associated with potential contaminants namely fungi or viable seed. Please note that these assessments are highly context-specific and cannot be extended to cover other commodities without further research.

Dyeing

Overview of dip-and-rinse dyeing:
Dip-and-rinse dyeing involves immersing a portion or all of a dried plant part into an aqueous or non water-based dye solution for a period of time so that the dye is taken up into the plant tissues directly from solution (http://www.dmcolor.com/products/?id=32). This is different to the systemic dyeing method of flower dyeing whereby the flower stem is placed in a warm dye solution and the plant's functional xylem then draws the dye up the stem to the petals (http://www.preservedgardens.com/flower-dye.htm). Flower dyeing by the latter method alone has no value in eliminating fungal pathogens because only a small part of the plant is immersed and the temperature must be relatively low to avoid damaging the plant. In contrast the dip-and-rinse treatment, when applied to the entire plant part, may have considerable potential as a means of eliminating fungal pathogens from the commodity.

Dip-and-rinse dying treatments can potentially have fungicidal properties in two ways. Firstly, there is the chemical consideration, ie the constituents of the dye compound itself. Secondly, because the retention of plant viability is not required for dyeing dried plant material, there is the potential to use heat.

Fungicidal properties of dye chemicals:
It is possible that the dyeing compound itself could be made to be intentionally fungicidal, or (if not) it could have compounds with fungicidal properties. A fungicidal dye could be desired by manufacturers of ornamental presentations, baskets and furniture as it would provide the finished product with a degree of resistance to mould. There is one non-aqueous dip-and-rinse commercial flower dye called Design Master 'Dipit'; although the only listed ingredient is 5% sodium dodecylbenzene sulfonate (an emulsifier which may or may not have fungicidal properties), because 'Dipit' is solvent-based it is very likely to have a fungicidal capacity.

A chemical compound called 2-phenylphenol is used primarily as an agricultural fungicide, but it is also used in the manufacture of dyestuffs (http://www.freepatentsonline.com/4722736.html). Another example (although now banned in many countries because of its toxicity) is malachite green, which is used as a fungicide and to dye paper, silk and leather (Papinutti et al. 2006).

Some compounds are used in small amounts to reduce fungal pathogens in conjunction with hot water treatments for produce and cut flowers (eg. ethanol, calcium (1%), sodium bicarbonate (2%), benomyl or thiobendazole (200mg per L); Tang et al. 2007, Jaroenkit & Paull 2003), and it is possible that some of these compounds may be incorporated into dyestuffs. However some traditional dyeing processes will utilise naturally available extracts (eg Morindone, an intense red dye popular in India, is obtained from the root bark of a local plant Morinda tinctoria; http://en.wikipedia.org/wiki/Morindone), and these may well have little or no fungicidal effect in their application to dried plant material. Domestic clothing dyes and food colouring can also be used to dye plant material such as seagrass (eg http://users.zoominternet.net/~basketc/dye.html, http://handicraft.indiamart.com/products/decorative-items/dry-flowers/dyeing-dry-flowers.html).

Fungicidal properties of hot water:

Hot water treatments (HWTs) are normally applied to fruit and vegetable commodities and to cut flowers to prolong shelf or vase life. HWTs work by destroying fungal and bacterial pathogens, but also by activating the natural defence mechanisms inherent in the epidermal layer of the plant part which prevents the entry of such pathogens (Fallik 2004). Dipping red ginger flowers (Alpinia purpurata) at 50°C for 12-15 min extends the post harvest vase life, partly by killing saprophytic moulds, but primarily by inhibiting the negative geotropic response of the plant (Jaroenkit & Paull 2003).

Vegetative cells and conidia of most fungi are inactivated when exposed to 60°C for 5-10 min in vitro (Civello et al. 1997). Fungal pathogen kill is not always proportional to the temperature-time product of the HWT, although there are reports of certain species which indicate a linear relationship between the logarithm of the decimal reduction time and the temperature of the treatment (Tang et al. 2007). HWT's at relatively high temperatures (such as 80°C and above) are likely to have considerable negative impacts on many if not most species of plant inhabiting fungi, but there may be a few exceptions. A HWT of 1 hour at 50°C killed all but less that 1% of Colletotrichum acutatum spores suspended in water. This is a fungus which causes leaf curl and leaf necrosis on Anenome spp. (Doornik 1990). Phaeomoniella chlamydospora and Phaeoacremonium spp. are known to be resistant to hot water treatments; tests on these species showed they were sensitive to HWT after 15 and 30 min respectively, but some mycelia of Phaeoacremonium inflatipes still survived after 120 min at 51°C. Spores of Chalara paradoxa (pineapple black rot) can survive 58°C for 3 minutes (Tang et al. 2007). Spores are much more susceptible to heat treatment than mycelia, however dormant spores are known to be unaffected by hot water (D'Hallewin et al. 1997). Similarly, spores occurring inside plant tissue may be more resistant to HWTs and could require a higher temperature or a longer duration eg teleospores of Tilletia indica (wheat bunt fungus) occurring inside wheat seed sori can survive HWT at 60°C for up to 15 minutes, whereas all teleospores but one were destroyed within one minute at 80°C (Smilanick et al. 1997).

Conclusion:

The effects of dyeing on fungal pathogens have not been reported in the literature, and although dyes can have fungicidal components incorporated into them, it is not known how widely these are used by manufacturers of dyed dried plant material. For dyes that use solvents other than water (such as volatile organic compounds), heating is not required due to the high likelihood of the solvent itself having fungicidal properties. With regard to water-based dye solutions, there is evidence of a linear relationship of fungal reduction in response to hot water treatment over time, therefore it is recommended that the process of dyeing dried foliage by fully immersing the item for 3 minutes in an aqueous dye whilst maintaining a near-boiling temperature (between 80 and 100°C) will likely destroy any contaminating conidia and mycelia occurring on or in the plant part. Dyes that have a non-aqueous base can be applied without heat.

The application of heat may mean that the dyeing process is limited by plant hardiness, since the less robust dried plant parts (such as flower petals) may become heat damaged during the dip; because of this it may not be applicable across all dried plant commodities as a generic treatment. It will probably be best suited for conifer products and items made from flax, raffia, seagrass etc. Another limitation is that dyeing at high temperatures may not be totally effective for eliminating dormant spores.

The intended indoor use of most commodities incorporating dyed dried plant material means that it is unlikely that the exposure of any surviving dormant spore will be any higher than for the same spores entering on any other pathway. Dormant spores could potentially occur unnoticed and enter the country untreated on any inert surface and have much higher likelihoods of exposure, eg on 'clean' gardening equipment. Therefore although the level of risk of spores on dyed dried foliage is non-negligible, provided the paperwork has the appropriate declaration to describe the proposed hot dyeing process, it is recommended that no further action will be required for entry into New Zealand and an inspection for contaminants will not be required.

Bleaching

Overview of bleaching:
Sodium hypochlorite (NaOCl) is routinely employed as a plant dip in order to remove external fungal and bacterial pathogens from live plants (eg Grenfell & Shadrack 2004), and it has also been used to prolong the shelf life of fruit and vegetables (eg Souza et al. 2005). As for many dip treatments, the concentration and the duration of the bleaching are likely to be the main factors involved in determining its efficacy on plant material. A few studies have also incorporated the effects of lowered pH and increased temperature in order to allow for a lower period of exposure to bleaching (or a lower concentration).

Summary of the literature:
Concentration – time effects:

- Soaking plants in a 10% solution of household bleach for to 2 hours is reportedly effective for preventing Sclerotium rolfsii and S. rolfsii var. delphinii (petiole blight) from recurring on Hostas plants (Grenfell & Shadrack 2004).
- Treating rice bitters explants with 20% bleach for 20 minutes lowered the contamination rate to 50% (Webster et al. 2003)
- Soaking in a 1.6% solution of NaOCl for 15 minutes was effective in destroying all free teleospores of Tilletia indica (carnal bunt fungus of wheat) but not those inside the sori of wheat seeds (room temp). 99% of free teleospores were killed after 7 minutes. Soaking in a 0.25% solution of NaOCl for 18 minutes killed teliospores of Tilletia controversa (room temp) (Smilanick et al. 1997).
- 15 m per L NaOCl was diluted at various rates and yam minisetts were soaked for 7 days (room temp). Dilutions of 1:15 and 1:10 prevented colony formation of Sclerotium rolfsii, while Cladosporium sp. and Penicillium sp. required the highest (1:5) concentration to prevent colonies. All other species (Aspergillus flavus, Fusarium sp., Rhizopus stolonifer and Trichoderma lignorum) survived the concentration of 1:5, with T. ligrorum the most resistant (Asare-Bediako et al. 2007).
- Soaking in a 1.0 % of NaOCl solution for 15 minutes was the best rate to control pathogenic fungi on sweet potato leaf explants (Gonzalez et al. 1997).
- Soaking in a 1% NaOCl solution for 30 minutes was best for controlling pathogens on coffee leaf explants (Naidu et al. 1993).
- A number of studies suggest a higher concentration is less effective at preventing rot than a lower concentration eg on rice bitter explants 20% gave 50% contamination while 10% gave 40% contamination (Webster et al. 2003); on lettuce leaf samples 100ppm gave better results than 150ppm (Souza et al. 2005); and on piper betel leaves a higher concentration for a longer period had adverse effects on leaf quality (Negi & Chaurasia 1995). These are probably the effects of the physiological damage caused to the plant by stronger bleaching making it more susceptible to fungal attack.

It is assumed that for dried foliage a higher concentration of bleach will destroy fungi more effectively than lower concentrations, and longer durations will be more effective than brief exposures. It appears that concentrations as low as 0.25% NaOCl will be sufficient for eliminating many (if not most) species of fungi if the soaking period for dried foliage is extended beyond one hour. Data on the resistance of species is however fairly limited and it is possible that structures such as dormant spores may be resistant. It appears bleaching studies use a variety of measures, so it is important that consistent measures of concentration are provided by exporters (specifically, the concentration of sodium hypochlorite in solution, as opposed to the rate of dilution of household bleach).

pH effects:

- Rinsing plants with a solution of 100ppm NaOCl buffered to pH7 treats Erwinia (soft rot of swede) and Chalara elegans (Thielaviopsis basicola) (Black root rot of carrot) (Anonymous 2003, Punja & Gaye 1993)
- NaOCl buffered to pH 8 before use was superior to NaOCl at pH 11.5 for treatment of free teleospores of Tilletia indica. Acidified bleach (pH 7) also reduced fungal growth on rice bitters explants compared with pH12 (Webster et al. 2003)

- The bactericidal action of hypochlorite solutions (bleach) is due to both hypochlorous acid (HOCl) and the OCl- ion, with the former being more active, so that the disinfecting efficiency of chlorine is best in slightly acid hypochlorite solutions (George 1993). Presumably lowering the pH has a similar efficiency on fungal pathogens.

It appears that lowering the pH of the bleach solution will increase the effectiveness of bleaching for killing many or most species of plant fungi pathogens. It is possible that this might also assist in destroying any resistant fungal species or dormant spore structures.

Temperature effects:

- Heating NaOCl solution to 50degC killed Tilletia controversa teleospores in 3 minutes compared to 18 minutes at 23degC
- Heating NaOCl solution to 60degC killed 99% of T. indica teleospores in 0.2 minutes compared to 7.1 minutes at 25degC.
- Heating NaOCl solution to 80degC killed all free teleospores of T. indica, across all concentrations and durations tested (0.53% and 1.6%; 1,5,15 and 30min), and all but two teleospores inside the sori of wheat seeds (Smilanick et al. 1997).

It is appears that maintaining a dip temperature of at least 50degC could increase the effectiveness of bleaching for killing fungal pathogens including internal fungi, and it is possible that this might also assist in destroying any resistant fungal species or dormant spore structures. Further increasing the temperature to 60 or 80degC will probably have cumulative fungicidal effects.

Conclusion:
The application of bleach as a fungicide dip for living plants appears to have wide use in horticulture (although higher concentrations are detrimental to plant health), and this does give some indication of its generic effectiveness as a potential treatment for dried plant parts. Having assessed this information along with that concerning the tolerances of individual fungal species, it is recommended that the proposed bleaching treatment, entailing soaking the material in a solution of 3% NaOCl at room temperature for at least 8 hours, is likely to be sufficient to destroy many or most fungi occurring on dried plant material. The likelihood of destroying all fungi will be increased by lowering the pH and/or increasing the temperature of the bleaching solution above room temperature.

It is important that measures of concentration are used consistently by exporters (specifically, the concentration of sodium hypochlorite in solution, as opposed to the rate of dilution of household bleach which appears to be more often used in horticultural practise).

Any residual traces of live or dormant fungi occurring on bleached dried foliage being imported to New Zealand will have likelihoods of entry and exposure similar to dried foliage which has undergone a hot dye treatment. As such, the risk will be comparable to that of fungi being imported unnoticed on inert surfaces. Therefore although the level of risk of spores on bleached dried foliage is non-negligible, provided the paperwork has the appropriate declaration to describe the proposed bleaching process, it is recommended that no further action will be required for entry into New Zealand and an inspection for contaminants will not be required.

Freeze drying

Overview of freeze-drying:
Freeze drying (or ‘lyophilisation’) is a process of preservation employed by freezing an item in a vacuum, and gradually raising the temperature or the pressure usually over a period of days or weeks in order to cause any ice to evaporate. There is considerable merit in assessing whether the commercial process used by manufacturers for freeze-drying cut flowers can be applied in its current form as an effective means of seed devitalisation, and equally important, whether freeze-drying can be made an approved treatment for plant products in general being exported to New Zealand. The practice of freeze-drying for the purpose of seed devitalisation has limited value in contexts outside of biosecurity and for preserving the intellectual property rights of seed, and it was not explored as an option until very recently; therefore literature concerning its efficacy is still relatively scarce. Freeze

drying is however an increasingly common means of preserving cut flowers, fruit and other botanicals in wedding bouquets and other showpieces.

Freeze-drying of viable seeds for storage:
To date, the potential for freeze-drying alone to be used as a method for devitalising seeds does not appear to have been investigated. Freeze drying is frequently used in agriculture by commercial seed producers to prolong seed shelf life by eliminating the risk of seed putrefaction. The effects on seed germination can occasionally be detrimental, but evidence is sporadic. Cowpea is one species adversely affected by low seed moisture content brought about by freeze-drying (Meng et al. 2005). Similarly germination % was reduced by freeze-drying for 72h at -50degC by 15, 9 and 10% for the grasses Poa pretensis, Dactylis glomerata and Phleum pratense respectively (Vlk et al. 1986). Drought resistance in pine seeds was impaired when they were freeze-dried to reduce moisture content to 2.4% (Larson & Davault 1974). The endosperm of freeze-dried brown rice kernels formed sponge-like structures and were said to become more fragile than that of untreated kernels (Kim et al. 2001).

Overall the standard practise of freeze-drying of commercial seed does not appear have any appreciable effects on % germination success for most crop species compared with untreated control batches, and in some cases it can improve germination success. As examples: seeds of leek, tomato, radish, aubergine and cucumber were not affected by having a moisture content reduced to 3-5.5% by freeze drying at -20degC (Zheng et al. 2001); neither was Chinese cabbage with seed moisture of 1.6% (Cheng et al. 1991); nor Cyclamen persicum seed (Neveur et al. 1986); nor clover, Anthyllis vulneraria, birdsfoot trefoil and sainfoin (Curiova et al. 1984); nor grass species including Lolium multiflorum, L. perenne and Festuca pratensis when seed moisture was reduced by freeze-drying for 72h at -50degC (Vlk et al. 1986). Freeze drying of seed has been used beneficially for storing seed of forest crop species and for tree conservation: seeds of birch, alder, pine and spruce can all be freeze dried to 3.5% without appreciable loss of viablility (Anisko et al. 2006), and the Brazilian native Tabebuia heterophylla can tolerate a reduction of moisture content to 3.4%. In grape seed and a number of other species including lucerne, freeze drying benefits production by improving the rate of germination (Wilde & de Darne 1996; Curiova et al. 1984).

Freeze-drying of seeds after imbibing:
In 2008 a seed devitalisation technique was devised which involves freeze-drying being first preceded by a seed imbibing process (http://www.freepatentsonline.com/y2009/0133165.html). Unlike freeze-drying alone, freeze-drying applied in this way has the potential to be a very effective means of treatment for plant product commodities. It is suggested that imbibing the seed (soaking in water) hydrates the cells and organelles necessary to initiate seed germination and these hydrated cells and organelles are then at least partially destroyed by freezing, thereby rendering the seed non-viable. In this manner, the method may be referred to as a “freeze-fracture” approach. Normally, for the intended purposes of seed protein and DNA analysis, actual germination is not desirable so temperature and duration are both minimised during the imbibing phase in order to avoid shoot emergence.

Seeds are first soaked in tap water for up to 48 hours to instigate the first phase of germination. Often a seed-coat softening agent is included to assist the process such as potassium nitrate or ethaphon (a plant growth regulator); the rate of imbibing is also increased by raising the temperature of the water (eg up to 60degC). Following this the water is removed and the seeds are subjected to freeze-drying which has the effect of both destroying seed viability as well as preparing the sample for dry storage. Most studies have an intermediary freezing stage which is employed before freeze-drying or another drying process; however with freeze-drying this is not essential since freeze-drying denatures the seeds regardless.

This technique is claimed by the developers to be extremely effective (100% devitalisation success is said to be normal for ‘any type’ of seed). 100% effectiveness was shown for seeds of corn, cotton and soybean imbibed for various durations at 10degC, frozen at -20degC for 16h, and then freeze-dried to 12 wt % moisture content. Corn seeds were imbibed for 24 h, cotton seeds for 48 h and soybean seeds for 6 h.

An equivalent process was demonstrated in a separate study to be 100% effective in devitalising maize and cotton seeds, whereby the seeds were soaked in deionized water overnight at 4 degC, drained and then fully submersed in liquid nitrogen for 3-5 minutes before being again drained, then freeze-dried for one week (Schafer et al. 2008).

Commercial freeze-drying of floral arrangements:
Freeze drying is increasingly used as a method of commercial flower drying and preservation. In essence plant material, usually flowers, is held in a chamber where it is frozen to -20 degF (-29 degC). It is then subjected to a vacuum whilst being gradually returned to room temperature over a period of between 10 days and 4 weeks. Each flower is then dipped in a sealant solution to prevent the uptake of moisture and allowed to dry for a minimum of 36-48 hours. Flowers are often pre-treated with a solution which increases tissue permeability and assists the desiccation process during freeze-drying. Recent improvements in the formulation of pre-treatment chemicals have enabled an ever-increasing range of flower, fruit and vegetable arrangements to be preserved by freeze-drying. They are used by interior designers, gift shop owners and by wedding bouquet preservers, and are increasingly used in restaurants and company foyers. Most cut flowers can be preserved by freeze-drying but the following species are considered to be best suited for this process: Anthurium, Gardenia, Ginger, Heliconia, Hyacinth, Liatris, Calla Lilly, Narcissus, Cattleya and Japhet Orchid, Tuberose and Bird-of-Paradise (http://www.hellerandreid.com/cgi-local/SoftCart.100.exe/about/faq_bridal.html?E+scstore+#5step; http://www.florage.com/freeze-dried-flowers.html; http://www.botaniquefrzdry.com/what_is_freeze_drying.shtml; http://www.freezedry.com/fl_overview.htm).

Conclusion:
Freeze-drying will have considerable merit as a seed devitalising technique for seeds on many plant products, but only when preceded by an imbibing process that initiates seed germination. It is likely that freeze-drying immediately after an imbibing period of at least 24 hours in tap water at room temperature will be sufficient to destroy viability for many types of seeds on commodities that incorporate dried non-viable plant products with seeds. The current method of commercially freeze-drying cut flowers and other plant parts appears to incorporate both a pre-soaking phase as well as a relatively prolonged freeze-drying period (apparently more than 4 weeks for some plant types). It is assumed that the pre-soak will be an aqueous solution, and it will therefore have an imbibing effect on seeds. Hence it is likely that commercial freeze-drying which is preceded by dipping in a pre-soak solution for at least 24 hours will be sufficient to destroy seed viability for many types of seeds in consignments intended to be exported as dried ornamental plant arrangements.

There is uncertainty over whether imbibing and freeze-drying will be 100% effective for devitalising all seeds across all plant families, since some species may require cues in addition to moisture in order to break dormancy and germinate. For many Acacia species in wildfire zones, species germination is inhibited unless seeds are exposed to woodsmoke in an aerosol or aqueous form. Other species require scarification or heat-shock, eg seeds of Acacia tetragonophylla and Stylobasium spathulatum have low imbibition, but this increases with hot-water treatment. Ripe seeds of Avena fatua (wild oat) do not germinate in water even after one month. Therefore, increasing the duration of the imbibing period (to 48 hours, for example) or raising the temperature of the solution above room temperature (eg to 50°C) will likely increase the efficacy of the freeze-drying treatment to cover some of the more resistant species. The level of efficacy can be further improved by the addition of agents that help break dormancy (such as gibberellic acid, potassium nitrate and/or ethaphon) to the water during the imbibing phase. This will not only broaden the range of seed types likely to be devitalised by freezing, it will also allow for a shorter and less damaging imbibing phase for fragile commodities.

Any seeds that have not broken dormancy during the 24 hour imbibing or pre-soaking phase would be unlikely to germinate in New Zealand unless they become exposed to relatively extreme conditions (eg in the case of some Acacia species, heat or smoke). Furthermore the intended indoor use of most dried plant commodities means that there would be very little opportunity for such exposure. As such, provided the paperwork has the appropriate declaration to state that the dried plant material has undergone the proposed pre-soak/ imbibing process followed by freeze-drying, it is recommended that no further action will be required for entry into New Zealand.

References:

Anonymous (2003)
http://www.westernforum.org/WCPD_documents/Archived_files/Archived%20Guidelines/Guidelines Oct02_Oct03/vegetables.pdf

Anisko, E., Wltowska, O. & Zaeski, A. (2006) Effect of drying conditions on viability of common birch, black alder, Scots pine and Norway spruce seeds. Lesne Prace Badawcze 2: 91-113

Asare-Bediako, E., Showemimo, F.A., Opoku-Asiama, Y. & Amewowor, D.H.A.K. (2007) In vitro analysis of growth media and the control of yam minisett-rot.
Biotechnology 6(1): 40-44 http://www.scialert.net/pdfs/biotech/2007/40-44.pdf

Chen, S.S.C. & Chang, J.L.L. (1971) Does Gibberellic Acid Stimulate Seed Germination via Amylase Synthesis? Department of Biological Sciences, University of Illinois
http://www.plantphysiol.org/cgi/reprint/49/3/441.pdf

Cheng, H.Y., Zheng, G.H. & Tao, K.L. (1991) Effects of ultradrying on ageing, cell ultrastructure and vigour of Chinese cabbage seed. Plant Genetic Resources Newsletter 83-84: 9-14

Commandera, L.E., Merritta, D.J., Rokicha, D.P. & Dixona, K.W. (2009) Seed biology of Australian arid zone species: Germination of 18 species used for rehabilitation. Journal of Arid Environments 73(6-7): 617-625

Curiova, S. Vlk, J. Vacek, V. (1984) The effect of sublimation drying on the germination capacity of legume seed crops. Pol'nohospodarstvo. 30(7): 642-647

Doornik, A.W. (1990) Hot-water treatment to control Colletotrichum acutatum on corms of Anemone coronaria. Acta Hort. (ISHS) 266: 491-494 http://www.actahort.org/books/266/266_65.htm

Fallik, E. (2004) Prestorage hot water treatments (immersion, rinsing and brushing). Postharvest Biology and Technology 32(2): 125-134

George, E.F. (1993) Plant propagation by tissue culture. Part 1. The Technology. Exegetics Limited. 574p

Gonzalez, O., Silva, J. & Meneses, S. (1997) Disinfection of sweet potato explants (Ipomoea batatas (L.) Lam.). Centro Agricola. 24(1): 26-29

Grenfell, D. & Shadrack, N. (2004) The color encyclopaedia of Hostas
http://books.google.co.nz/books?id=fUdyIfqhoLsC&pg=PA45&lpg=PA45&dq=bleach+treatment+leaf+fungi&source=bl&ots=lZ1sIPnCBh&sig=JhmlI_jXZjocVhQhNw_q0YhxZ4U&hl=en&ei=p82dSr7nN4WesgOZ4rEh&sa=X&oi=book_result&ct=result&resnum=4#v=onepage&q=bleach&f=false

Hara, A.H., Hata, T.Y., Hu, B.K.-S. and Tsang, M.M.C. (1997) Hot-air induced thermotolerance of red ginger flowers and mealybugs to postharvest hot-water immersion. Postharvest Biol. Technol. 12: 101–108

Jaroenkit, T. & Paull, R.E. (2003) Postharvest handling of Heliconia, red ginger, and bird-of-paradise. HortTechnology 13: 259-266

Kim, S-L., Son Y-K., Son, J-R. & Hur H-S. (2001) Effect of germination condition and drying methods on physicochemical properties of sprouted brown rice. Korean Journal of Crop Science. 46(3): 221-228

Kulkarni, M.G., Sparg, S.G. & Van Staden, J. (2007) Germination and post-germination response of Acacia seeds to smoke-water and butenolide, a smoke-derived compound. Journal of Arid Environments 69(1): 177-187

Larson, M.M. & Davault, M. (1974) Pine seeds withstand severe drying before, after germination: seedling drought tolerance may be reduced. Tree Planters' Notes. 26(1): 22-23

Meng S-C., Zhang H-Y., Liu P-Y. & Kong X-H. (2005) Effect of ultra-drying of large amount of vegetable seeds at 50 degrees C. Acta Agriculturae Boreali-Sinica. 20(4): 78-81

Webster, S., Mitchell, S.A. & Ahmad, M.H. (2003) A novel surface sterilization method for reducing microbial contamination of field grown medicinal explants for in vitro culture. http://www.kitchenculturekit.com/surfaceSterilizationMitchell2003.pdf

Naidu, M.M., Muniswamy, B. & Sreenah, H.L. (1993) Comparative efficacy of four disinfectants for raising aseptic leaf cultures of coffee (Coffea canephora Pierre ex. Froehner). Journal of Coffee Research. 23(1): 47-54

Neveur, N., Corbineau, F. & Come, D. (1986) Some characteristics of Cyclamen persicum L. seed germination. Journal of Horticultural Science. 61(3): 379-387

Negi, R.S. & Chaurasia, R.K. (1995) Efficacy of different chemicals/sterilents for the control of post-harvest rotting of betelvine leaves. Indian Phytopathology. 48(2): 199-201

Papinutti, L., Mouso, N. & Forchiassin, F. (2006) Removal and degradation of the fungicide dye malachite green from aqueous solution using the system wheat bran-Fomes sclerodermeus. Enzyme and microbial technology. 39(4): 848-853

Punja, Z.K. & Gaye, M.M. (1993) Influence of postharvest handling practices and dip treatments on development of black root rot on fresh market carrots. Plant Disease 77: 989-995

Schafer, B.W., Cai, C.Q., Embrey, S.K., Herman, R.A. & Song, P. (2008) Devitalization of Transgenic Seed That Preserves DNA and Protein Integrity.
J Biomol Tech.19(5): 348-352

Silva, A., da Figliolia, M.B., Aguiar, I.B. & de Perecin, D. (2001) Lyophilization and storage of seeds of Tabebuia heterophylla (A.P. Candolle) Britton - Bignoniaceae.
Revista Brasileira de Sementes. 23(1): 252-259

Smilanick, J.L., Hershberger, W., Bonde, M.R. & Nester, S.E. (1997) Germinability of Teliospores of Tilletia indica after Hot Water and Sodium Hypochlorite Treatments. Plant Disease 81(8): 932-935

Souza, E.C., Piccoli, R.H., Boari, C.A., Chitarra, A.B. & Chitarra, M.I.F. (2005) Fresh-cut lettuce: use of different sanitation treatments to reduce microbial load.
Acta Horticulturae. 682(3): 1847-1850

Tang, J., Mitcham, E., Wang, S. & Lurie, S. (eds) (2007) Heat treatments for postharvest pest control. CAB International, UK. (first edition). 349p

Vlk, S., Curiova, S. & Vacek, V. (1986) Responses of seeds of some grass species to freeze drying. Rostlinna Vyroba. 32(3): 225-228

Wilde, A. & de Darne, G. (1996) Attempts to improve the germination of grape seeds.
Journal International des Sciences de la Vigne et du Vin. 30(3): 113-120

Woodstock, L.W., Simkin, J. & Schroeder, E. (1976) Freeze-drying to improve seed storability. Seed Science and Technology. 4(2): 301-311

Zhang H-Y. & Kong X-H. (1999) Storage of freeze-dried Chinese cabbage seeds. China Vegetables 2: 21-23

Zheng X-Y., Li X-Q. & Chen, H. (2001) Effect of different ultra-drying methods on vegetable seeds for long-term storage. Acta Horticulturae Sinica. 28(2): 123-127

Zheng, X-Y., Li, X-Q. & Ma, L-P. (2001) Research on freeze-drying and vacuum-drying of orthodox seeds for long-term storage. IPGRI Newsletter for Asia, the Pacific and Oceania 34: 22-23

APPENDIX 5:

Brush and Screening fencing/roofing Product Illustrations

Thamnochortus insignis (Sth Africa)
Tropical reed tile

Thamnochortus insignis (Sth Africa)
Custom thatch tile

Thamnochortus insignis (Sth Africa)
Standard thatch tile

Melaleuca fencing (Australia)

Baeckea fruitescens fencing (China)

Fern screening (China)

Cunninghamia lanceolata
Bark screening (China)

Bamboo screening (China)

Willow screening