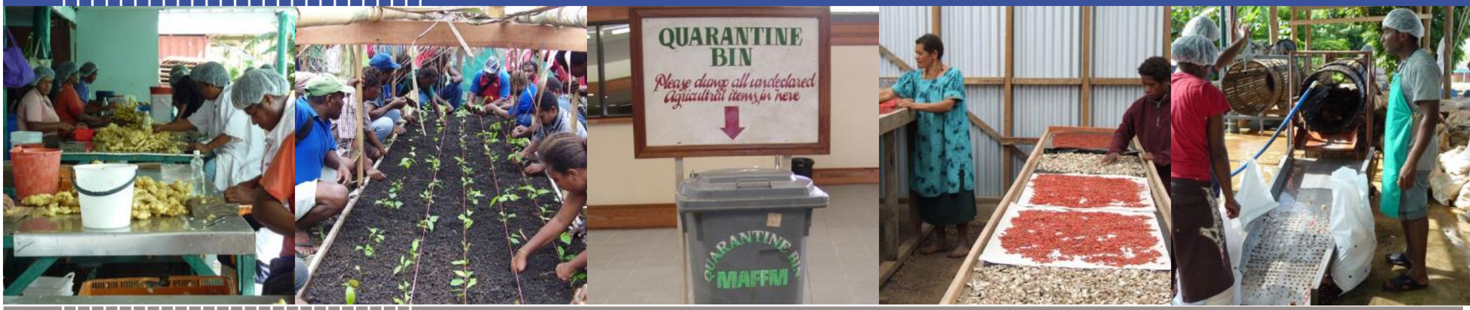

Pacific Horticultural and Agricultural Market Access Program (PHAMA)

Response to Biosecurity Australia

Draft Review of Import Conditions for Fresh Taro Corms

15 MAY 2011

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Abbreviations

Abbreviation	Description
ACIAR	Australian Centre for International Agricultural Research
ALOP	Appropriate Level of Protection
AQIS	Australian Quarantine and Inspection Service
BSG	Biosecurity Services Group
CBDV	Colocasia Bobone Disease Virus
NPPO	National Plant Protection Organisation
PHAMA	Pacific Horticultural and Agricultural Market Access Program
PIC	Pacific Island Country
PNG	Papua New Guinea
PRA	Pest Risk Analysis
SPC	Secretariat of the Pacific Community
TaVCV	Taro Vein Chlorosis Virus
TLB	Taro Leaf Blight
UK	United Kingdom
URS	URS Australia Pty Ltd
USA	United States of America

Executive Summary

The *Draft Review of Import Conditions for Fresh Taro Corms* was released for public comment by Biosecurity Australia on 1 March 2011 and the Pacific Horticultural and Agricultural Market Access program (PHAMA) submit comments for consideration prior to finalisation of this review policy.

PHAMA feels that the draft review has correctly assessed the risk posed by many of the pests and diseases within this draft document. However, comment is provided where estimates of risk are considered too high. One of the primary risk considerations for fresh taro corms should be that corms are imported into the capital cities (primarily Melbourne, Canberra and Sydney) for human consumption. Waste is not distributed to taro production areas but rather disposed of in urban landfill or backyard composts of Melbourne, Canberra and Sydney where no taro production exists. It appears that this very important fact has not been taken into consideration for some pests and diseases.

In particular, PHAMA considers that the risk posed by Fiji ginger weevil, taro beetles, taro plant hopper, taro leaf blight and taro vein chlorosis virus were significantly overestimated and the imposition of the proposed risk management measures for these pests would represent a significant barrier to trade.

PHAMA also notes that there is no reference to surveys for pests and diseases of Australian taro production areas. Surveys of taro pests and diseases were widely conducted and documented within the Pacific Island regions. Importantly, no such surveys of pests and disease are reported within this draft document for Australia and it is understood that no such surveys have been conducted in Australia.

PHAMA believes that this lack of survey data is a fundamental flaw within this draft document as the germplasm used to develop Australia's commercial taro industry originated from Pacific Island countries. PHAMA requests, that in light of these considerations, a full and rigorous pest and disease survey of the Australian taro industry is conducted, documented and reported to the scientific community before this review is finalised.

Finally, these comments are offered in the spirit of mutual cooperation to ensure that Australia's revised import policy for fresh taro corms is based on sound science and that it will ensure that Pacific Island Countries (PICs) can continue to stabilise and further develop the very important Australian export market for fresh taro corms. PHAMA seeks ongoing dialogue and cooperation with the Biosecurity Services Group (BSG) to finalise this draft policy document and to implement commercially viable export/import operational policy for fresh taro corms from PICs.

Introduction

Fresh taro corms are one of the few commodities for which Pacific Island Countries (PICs) have been able to achieve significant levels of exports, with 10,000–12,000 tonnes exported annually. Fiji currently accounts for the majority of these exports but there has been little or no growth in these exports in recent years. However, there is potential for significant improvement if a commercially viable quarantine protocol is developed and substantial improvements in the taro production pathway, export certification and marketing occurred. Increased exports would result in substantial benefits for large numbers of low-income PIC taro producers and their families.

The *Draft Review of Import Conditions for Fresh Taro Corms* was released for public comment by Biosecurity Australia on 1 March 2011 and the Pacific Horticultural and Agricultural Market Access Program (PHAMA) submit the following comments for consideration prior to finalisation of this draft review policy.

1.1 Existing Policy

Prior to the introduction of emergency measures in 2006 prohibiting the importation of small corm taro, Australia permitted the importation of fresh corms of *Colocasia esculenta* (including var. *antiquorum*) for human consumption from all countries, subject to specific import conditions. These import conditions included:

- Topping to remove all petiole bases, the apical growing point and all foliage
- On-arrival inspection for quarantine pests and other regulated articles (e.g. soil, trash and seeds).

Following the prohibition of small corm taro imports in 2006, a further condition was added to require that imported corms meet specific morphological criteria to ensure corms of *Colocasia esculenta* var. *antiquorum* do not gain entry (Australian Quarantine and Inspection Service [AQIS] 2011). Specifically the corms must:

- Be at least 15 cm long or be at least 7 cm in diameter at the widest point
- Be at least 300 g in weight
- Be free of lateral buds or shoots
- Lack shaggy hair.

PHAMA notes that a significant volume of trade had occurred prior to the introduction of emergency measures in 2006 and subsequent changes to import conditions again in 2011. Have there been any recorded incidences of imported taro corms being used as propagative material for commercial plantings during this significant period of historical trade? Further, has there been any recorded incidence of entry, establishment and spread of pests of quarantine concern associated with such plantings?

PHAMA is not aware of any such incidences nor have any such incidences been reported by the Australian National Plant Protection Organisation (NPPO) to international fora. If this is indeed the case, is the increasing regulatory nature of policy associated with taro imports into Australia more a result of increasing pressure from a small Australian domestic rather than any perceived quarantine risk based on sound science?

1.2 Next Steps

PHAMA requests further consultation with Biosecurity Australia once submissions received have been considered prior to finalisation of this very important policy document.

Pest Categorisation

Pest categorisation is a crucial element of a PRA and a clear and concise understanding of the pest and disease status of the commodity within the PRA area is essential for the categorisation process to accurately assess the risk. Surveys of taro pests and diseases have been widely conducted and documented within the Pacific Island regions (Ismay and Dori (1985); Greve J van and Dori (1983); French B (1987); Kumar R (2001); Landare New Zealand (2002); Revill *et al*. (2005); Carmicheal *et al* (2006); Davis R *et al,* (2008, 2009, 2007); Davis R, et al (2010)). The Pacific plant pest list database (www.pld.spc.int/lrd/pld) contains updated records of these surveys.

Importantly, no such surveys of pests and disease are reported within this draft document for Australia taro production regions and it is understood that no such surveys have been conducted in Australia. The lack of comprehensive information on pests and diseases present within Australian taro populations is further reinforced by the fact that Matthews (2003), an archaeologist, was the first to find *Tarophagus colocasiae* in Australia after inspecting only twelve locations in northern Queensland. In addition, Taro bacilliform virus (TaBV) was located as a chance discovery by a student at the University of Queensland farm at Redland Bay. Given these chance detections, PHAMA has to ask what other pests and diseases currently of quarantine concern to Australia are actually present but undetected within Australia taro stock.

PHAMA believes that this lack of survey information is a fundamental flaw within this draft document, as much of the germplasm used to develop Australia's commercial taro industry originated from Pacific Island countries. PHAMA requests that in light of these considerations a full and rigorous pest and disease survey of the Australian taro industry is conducted, documented and reported to the scientific community before this review is finalised.

Time and Volume of Trade

Biosecurity Australia has based the PRA on the assumption that a 'substantial' volume of trade would occur. In the case of the PICs, taro imports have remained stable or in some cases have markedly declined over the past 20 years. Taro imports into Australia from PICs (primarily Fiji) have remained at about 2000 tonnes per year since 2005 (McGregor et al 2011). Further, this volume of imported taro is distributed to PIC communities within the capital cities (primarily Melbourne, Canberra and Sydney) for human consumption. Waste is not distributed to taro production areas but rather disposed of in urban landfill or backyard composts of Melbourne, Canberra and Sydney where no taro production exists. PHAMA suggests that this volume from PICs into these geographic regions poses negligible risk of entry and spread of any pests and diseases of quarantine concern.

Pest and Disease Comments

4.1 Fiji Ginger Weevil (*Elytroteinus subtruncatus*)

4.1.1 Probability of Importation

The overall assessment of Fiji ginger weevil being below the Appropriate Level of Protection (ALOP) is an accurate assessment. However, the estimated probability of import of low (up to 30% probability) of the weevil being imported with fresh taro corms is a substantial overestimate.

This statement is supported by the fact that only one weevil was intercepted in Sydney on unspecified goods from Fiji in 1963 (APPD 2009). Taro has been imported into Australia for many years from a number of Pacific countries where *Elytroteinus subtruncatus* is present without any further interceptions of this pest. Based on this one single record of interception within the past 48 years on unknown host material, PHAMA suggests that the likelihood for importation of this pest is **very low**.

4.1.2 Probability of Distribution

Similarly, the likelihood of distribution of moderate (30–70% probability) is also too high. Fiji ginger weevil is not a common pest of fresh taro corms and fresh taro corms are likely to be imported into the capital cities (primarily Melbourne, Canberra and Sydney) for human consumption. Waste is not likely to be distributed to taro production areas but rather disposed of in urban landfill or backyard composts of Sydney, Canberra and Melbourne where no taro production exists. The probability of distribution by definition requires successful transfer of the pest to a host. In view of the very low incidence of infestation and distribution of fresh corms to urban areas where no taro production occurs PHAMA suggests that the probability for distribution is **very low**.

4.1.3 Probability of Entry (Importation × Distribution)

Based on PHAMA comments the likelihood that *Elytroteinus subtruncatus* will enter Australia and be distributed in a viable state to a susceptible host, as a result of trade in fresh taro corms from any country where this pest is present, is **extremely low** rather than the current estimate of low.

4.1.4 Probability of Establishment

If a taro corm should be infested with ginger weevil it is likely that only single eggs would be laid in the corm. A single egg does not constitute a viable population. This fact combined with the extremely low incidence of infestation suggests that the likelihood of establishment is much less than the estimated low (up to 30%) likelihood. PHAMA thinks that the likelihood of establishment is **very low**.

4.1.5 Probability of Spread

An estimate of likelihood of spread of moderate (up to 70%) contradicts the available biological distribution and spread data. *Elytroteinus subtruncatus* has not spread widely in Hawaii since it was first reported in 1918, despite the presence of hosts such as avocado and taro. Its distribution is restricted to parts of the island of Oahu (Follett *et al*. 2007). Further, *Elytroteinus* spp. weevils are flightless (New Zealand Ministry of Agriculture and Forestry 2008), so natural spread would be slow and longer distance spread would only occur via movement of infested produce. Based on these important facts, PHAMA thinks that the likelihood of spread is **very low**.

4.1.6 Probability of Entry, Establishment and Spread

Based on the above comments likelihood that *Elytroteinus subtruncatus* will be imported as a result of trade in fresh taro corms from any country where this pest is present, be distributed in a viable state to a susceptible host, establish and spread within Australia is **extremely low** rather than the current estimate of very low.

4.1.7 Consequences

PHAMA supports the consequences estimate for *Elytroteinus subtruncatus*.

4.1.8 Unrestricted Risk Estimate

PHAMA supports the unrestricted risk estimate but suggests that the probabilities of entry, establishment and spread are overestimates and requests that these likelihoods are revised downwards.

4.2 Taro Beetles

Eucopidocaulus tridentipes; Papuana biroi; Papuana cheesmanae; Papuana huebneri; Papuana inermis; Papuana japenensis; Papuana laevipennis; Papuana semistriata; Papuana szentivanyi; Papuana trinodosa; Papuana uninodis

4.2.1 Probability of Importation

The overall assessment of taro beetles being below the ALOP is an accurate assessment. However, the estimated probability of importation of low (up to 30% probability) of the weevil being imported with fresh taro corms is a substantial over estimate. PHAMA thinks that an estimate of **very low** is appropriate based on the following information:

Infested taro corms with large holes and associated frass are visibly obvious. Affected corms are likely to be detected and discarded either at harvest or at the packing house. The female beetles remain in the corms for only about a week and then spend most of their time laying eggs in humic litter (SPC 2003). Beetles remaining in the corms are most likely to be males (SPC 2003). Finally taro beetles have never been intercepted by AQIS in on-arrival inspections over 30 years of taro imports.

4.2.2 Probability of Distribution

The estimated probability of importation of low (up to 30% probability) of the weevil being imported with fresh taro corms is a substantial overestimate. PHAMA thinks that an estimate of **extremely low** would be appropriate based on the following information:

Only gravid females pose a risk of reproduction and hence establishment and spread, and females leave the corms after about a week to lay eggs. They are unlikely to remain associated with corms that have undergone harvest and pre-export sorting, grading and packing. Therefore any beetles that may remain in the corms after transport to Australia will be predominantly male and will be unable to reproduce and form a population within the PRA area.

4.2.3 Probability of Entry (Importation × Distribution)

Based on PHAMA comments the likelihood that taro beetles will enter Australia and be distributed in a viable state to a susceptible host, as a result of trade in fresh taro corms from any country where this pest is present, is **extremely low** rather than the current estimate of low.

4.2.4 Probability of Establishment

Taro beetles (*Papuana* spp.) have been recorded in Australia several times over the past century, but only *Papuana woodlarkiana* is considered to be present (Cassis *et al.* 1992; Brooks 1965). No other taro beetles have become established or spread, despite the presence of numerous hosts including *Colocasia esculenta*, a favourable climate, the use of various aroids as foliage plants in horticulture, and a taro industry that has existed in some form since the 1850s. Based on this information PHAMA thinks that the likelihood of establishment is **very low**.

4.2.5 Probability of Entry, Establishment and Spread

Based on PHAMA comments, the likelihood that taro beetles will be imported as a result of trade in fresh taro corms from any country where this pest is present, be distributed in a viable state to a susceptible host, establish and spread within Australia is **negligible** rather than the current estimate of very low.

4.2.6 Consequences and Unrestricted Risk

PHAMA supports the consequences estimate of moderate. However, the unrestricted risk estimate should be revised to **negligible** in the light of the suggested previous likelihood revisions.

4.3 Taro Plant Hopper (*Tarophagus Proserpina*)

4.3.1 Probability of Importation

The draft review quotes Matthews (2003) stating "Taro planthoppers can survive long journeys as unhatched eggs or juvenile forms inside or on their host". However, Matthews is writing about taro movements in antiquity as he goes on to say that "…. the planting materials carried on long-distance canoes must have included corms and petioles…. and that taro planthoppers could survive long journey as unhatched or juvenile forms inside their host …". These are events occurred thousands of years ago, not in commercial trade. It is improper to quote this reference out of context.

Matthews (2003) also says that historical transfers were probably done with special care: perhaps by wrapping plants in leaves, and storing in locations on board the rafts, which provided the best conditions of temperature, moisture and aeration.

It is also important to note that if the petioles trimmed to one or two cm with all the outer leaves removed, as is the case for taro imports into New Zealand, the chances of planthoppers being on or in the petioles is remote. It is acknowledged that there is a slight possibility of plant hoppers being present as external pests and these are readily detected.

Taro plant hopper only lays its eggs at the base of the petiole of the outer leaf sheaths and these are removed before processing of taro corms for export (Grahame Jackson pers comm.). It is extremely unlikely that consignments of fresh taro corms would contain eggs, nymphs or adults of the taro plant hopper embedded within inner leaf petiole bases. However, it is acknowledged that several adult plant hoppers were intercepted as external contaminants of fresh taro corms during many years of export to Australia. A likelihood of **low** rather than high is a more accurate estimate of risk.

4.3.2 Probability of Distribution

The majority of fresh taro corms from PICs are distributed to PIC communities within the capital cities, primarily Melbourne, Canberra and Sydney where there is no commercial taro production. Waste is not likely to be distributed to taro production areas but rather is disposed of in urban landfill or backyard composts of Sydney, Canberra and Melbourne where no taro production exists. The probability of distribution by definition requires successful transfer of the pest to a host.

In view of the low incidence of infestation (supported by interception data) and the distribution of the majority of imported fresh corms to urban areas where no taro production occurs PHAMA thinks that the probability for distribution is **very low**.

4.3.3 Probability of Entry (Importation × Distribution)

The likelihood that *Tarophagus proserpina* will enter Australia and be distributed in a viable state to a susceptible host, as a result of trade in fresh taro corms from any country where this pest is present is **very low** in light of the comments provided for importation and distribution.

4.3.4 Probability of Establishment

The majority of fresh taro corms imported from PICs are distributed to PIC communities within the capital cities, primarily Melbourne, Canberra and Sydney where there is no commercial taro production. Waste is not likely to be distributed to taro production areas but rather is disposed of in urban landfill or backyard composts of Sydney, Canberra and Melbourne where no taro production exists. The probability of distribution by definition requires successful transfer of the pest to a host. In view of the low incidence of infestation (supported by interception data) and the distribution of imported fresh corms to urban areas where no taro production occurs suggests that the probability for establishment is **low**.

The draft review document incorrectly states that other taro plant hopper species have established in wild taro populations in Queensland. Australian plant hopper species are endemic and the fact that they have increased their range does not provide evidence for a high likelihood of establishment.

4.3.5 Probability of Spread

Taro plant hoppers are host specific and fresh taro corms from PICs are distributed to PIC communities within the capital cities, primarily Melbourne, Canberra and Sydney where there is no commercial taro production. Waste is not likely to be distributed to taro production areas but rather be disposed of in urban landfill or backyard composts of Sydney, Canberra and Melbourne where no taro production exists. The probability of distribution by definition requires successful transfer of the pest to a host. It will not be possible for any introduced taro plant hoppers to spread under these conditions.

For **most** of the year adult taro plant hoppers have only short wings and cannot fly. However, it is acknowledged that long-winged forms may be present during cooler periods, or when the taro host plants mature and die. However, the cooler periods in southern areas of Australia, where imported taro is distributed, are likely to kill the taro plant hopper rather than facilitate flight. In addition, the documented flight distance of the rice brown plant hopper, *Nilaparvata lugens* of approximately 500 km (Matthews 2003) would be unlikely to disperse it to commercial taro production areas.

In light of the comments provided above, PHAMA thinks that the probability for distribution is **low.**

4.3.6 Probability of Entry, Establishment and Spread

The likelihood that *Tarophagus proserpina* will be imported as a result of trade in fresh taro corms from any country where this pest is present, be distributed in a viable state to a susceptible host, establish and spread within Australia is **very low** in light of the comments provided for importation and distribution.

4.3.7 Unrestricted Risk Estimate

In light of the revised entry, establishment, spread and consequence revisions the unrestricted risk of *Tarophagus proserpina* is **very low**. This revised unrestricted risk estimate for *Tarophagus proserpina* of ‘very low’ does not exceed Australia’s ALOP and no specific risk management measures are required for this pest.

4.4 Nematode Species

PHAMA agrees that the nematode species assessed are below the ALOP. On finalisation of this policy document and implementation of operational policy PHAMA will seek to work with Biosecurity Services Group (BSG) to ensure that consignments do not continue to require fumigation for nematodes as a precautionary measure, as has occurred with previous PIC consignments arriving in Australia.

4.5 Mite Species

PHAMA agrees that the mite species assessed are below the ALOP. On finalisation of this policy document and implementation of operational policy PHAMA will seek to work with BSG to ensure that consignments do not continue to require fumigation for mites as a precautionary measure, as has occurred with previous PIC consignments arriving in Australia.

4.6 Taro Leaf Blight (*Phytophthora Colocasiae*)

4.6.1 Probability of Importation

Taro Leaf Blight (TLB) *Phytophora colocasiae* is a disease of taro leaves, not of taro corms in the field; corm rots only start after harvest. In Hawaii, however, there is no experience of corm rots (Ed Trujillo, former plant pathologist; University of Hawaii, pers. comm.). In this case, either the incidence is low or absent in paddy-cultivated taro, or the biology is differs from other countries where post-harvest corm rots are reported (Gollifer & Booth 1973; Jackson & Gollifer 1975).

However, sporangia or zoospores have not been detected infecting intact petioles, except for the most susceptible varieties (Grahame Jackson; pers. comm.). In fact, lesions on petioles are not seen on the traditional varieties in Solomon Islands (Jackson & Gollifer 1975) or Papua New Guinea (PNG), or on the hybrids bred in Samoa (Tolo Iosefa; University of the South Pacific, pers. comm.). Thus, any spores that are carried on the innermost leaves after the outer petioles have been stripped as part of general processing would only be contaminants washed from the leaves. These would remain viable for a few hours only as they would rapidly desiccate inside a container (at ambient temperatures or cooled).

Putter (1976) stated that: “few sporangia were found in the water accumulated in petiole bases”. In his studies in PNG, only 9 of 841 samples yielded sporangia. Sporangia on leaf lesions are usually dead by midday (Putter, 1976; Fullerton & Tyson, 2004). Zoospores discharged from sporangia are fragile and unless they germinate and infect their suitable host, will desiccate as rapidly as the sporangia.

PHAMA suggests that the probability of introduction of *P. colocasiae* as lesions on petioles reduced to a few inner leaves and trimmed to a short stalk, or spores potentially present as contaminants on washed corms with short petioles attached is **very low**.

It is acknowledged that there is a separate risk if the probability of corm infections is to be considered. Although sporangia or other spore types have not been reported from infected corms in PICs, they readily form when mycelium taken from corms is grown on synthetic media under laboratory conditions. Furthermore, recent laboratory studies in Taiwan have shown oospore formation from zoospore inoculations of A1 and A2 segregates from a rare homothallic isolate (Lin & Ko 2008). However, there was no evidence presented from these studies that this occurs in nature.

Interestingly, work in the Pacific has shown some unexpected results: only one mating – A2, and some isolates (most of those in PNG) that did not form oospores when challenged with either A1 or A2 strains. Note the following (Fullerton & Tyson, 2004): *In a recent study of strains from the Pacific region (Tyson & Fullerton, 2003) only one mating type (A2) was found throughout the region, including Guam, Hawaii, Indonesia, Philippines, Papua New Guinea and Samoa. Strains of neuter (A0) mating type (no oospores formed with either tester) were found also from Indonesia, Thailand and Papua New Guinea – the majority of isolates from PNG were A0. While oospore formation can be readily induced between opposite mating types in culture there is no evidence that this occurs regularly in nature.*

In summary, the risk of importation is not from inoculum associated with trimmed back petioles, it is from corm rots, although it is uncertain as to the type of inoculum. Therefore, the overall risk that corms could be imported with inoculum of *P. colocasiae* is **moderate** for commercially produced corms from infested areas.

4.6.2 Probability of Distribution

The risk for distribution of TLB is associated with the possibility that the mycelium in the corms would sporulate, and the spores would be disseminated by wind and rain to taro host plants nearby.

Spores survive for a maximum of 24 hours before desiccating in humidities lower than 95%. Sporulation is affected by temperature with maximum occurring at about 22ºC. If sporulation did occur on corms, it could be over a period of about 10 days. After that, other fungi overrun the rots. In Solomon Islands, rots are rapidly invaded by *Lasiodiplodia theobromae* (Jackson & Gollifer (1975), a typical “wound” fungus.

The following summarises the epidemiology of *P. colocasiae* taken from (Trujillo & Aragaki 1964; Trujillo 1965, 1967; Putter 1976; Fullerton & Tyson 2001; Fullerton & Tyson 2004):

- Optimum sporulation occurs at 20–22ºC and 100% relative humidity.
- Maximum sporulation occurs between midnight and dawn. Sporulation and zoospore production in sporangia are totally inhibited below 90% relative humidity.

- Sporangia collected at 1400 hrs and 1600 hrs were not viable.
- In detached leaf tissue, the rate of symptom development is greatest at temperatures in the range 25°C–30°C; at 35°C symptom development is halted.
- There are two phases: endemic – dew and exudates cycle spores within the plant canopy; and epidemic – wind and heavy rain causes spread between plants and plantations over long (but undefined) distances.
- Most infections occur between 2400–0200 hr – cool temperatures and free moisture from rain or dew promote zoospore production from sporangia.

Considering that a) evidence for sporulation from corms is uncertain in the Pacific, b) that even if it did occur, the temperatures and humidities at ports of entry are unfavourable to sporulation and spore survival, c) the chance of spores being swept up by rain and wind and deposited to taro plants growing nearby is remote, and d) the fact that corms are rapidly destroyed after harvest by saprophytic fungi and other organisms, suggests that the probability for distribution of *P. colocasiae* should it enter in corms in Australia is **low**.

4.6.3 Probability of Entry (Importation × Distribution)

The likelihood that *Phytophthora colocasiae* will enter Australia and be distributed in a viable state to a susceptible host, as a result of trade in fresh taro corms from any country where this pathogen is present is **low** in light of the comments provided for importation and distribution.

4.6.4 Probability of Establishment

Phytophthora colocasiae is present in regions with climatic conditions similar to those existing in some coastal parts of northern Australia. However, the majority of fresh taro corms from PICs are distributed to PIC communities within the capital cities, primarily Melbourne, Canberra and Sydney where there is no commercial taro production. Waste is not likely to be distributed to taro production areas but rather be disposed of in urban landfill or backyard composts of Sydney, Canberra and Melbourne where no taro production exists.

New infestations initiated by spores typically occur via other infested plants in the vicinity (Fullerton & Tyson 2004). Further, Gollifer *et al*. (1980) reported that survival of sporangial inoculum in naturally infested soils was typically less than two weeks. Under normal circumstances large numbers of sporangia are washed to the soil. Most of these discharge zoospores lyse within the first five days (Fullerton & Tyson 2004). However, a small proportion develop thick walls, forming chlamydospores that are able to survive in artificially inoculated, oven-dried soil maintained constantly at three moisture-holding capacities – 75%, 90% and 100% (Quitugua & Trujillo 1998). Survival for up to 3 months occurred in the driest soil, but less than 41 days in the wettest. However, the importance of soilborne chlamydospores and oospores in the epidemiology of the disease has not been established.

In view of the evidence presented and the distribution of the majority of imported fresh corms to urban areas where no taro production occurs the probability for establishment should be revised to **low.**

4.6.5 Probability of Entry, Establishment and Spread

The likelihood that *Phytophthora colocasiae* will be imported as a result of trade in fresh taro corms from any country where this pathogen is present, be distributed in a viable state to a susceptible host, establish and spread within Australia is **very low** in light of the comments provided for entry and establishment.

4.6.6 Unrestricted Risk Estimate

In light of the revised entry, and spread revisions the unrestricted risk of *Phytophthora colocasiae* is **very low**. This revised unrestricted risk estimate for *Phytophthora colocasiae* on fresh taro corms of 'very low' does not exceed Australia's ALOP and no specific risk management measures are required for this pest.

4.7 Taro Pocket Rot – *Phytophthora* sp.

The probability of entry, establishment and spread for this *Phytophthora* sp. has been correctly assessed as very low. This assessment strongly supports PHAMA assertion that the probability of entry establishment and spread for *Phytophthora colocasiae* (another *Phytophora* species) should also be very low. Justification for the disparity of probabilities or entry, establishment and spread for these two diseases of very similar biology is requested to ensure that sound and consistent science has been applied throughout this draft review document.

4.8 Colocasia Bobone Disease – Colocasia Bobone Disease Virus (CBDV)

There is no reference to surveys for CBDV of Australian taro production areas. Surveys of taro pests and diseases were widely conducted and documented within the Pacific Island regions (Ismay and Dori (1985); Greve J van and Dori (1983); French B (1987); Kumar R (2001); Landare New Zealand (2002); Revill *et al*. (2005); Carmicheal *et al* (2006); Davis R *et al,* (2008, 2009, 2007); Davis R, *et al* (2010)). The Pacific plant pest list database (www.pld.spc.int/lrd/pld) contains updated records of these surveys.

Importantly, no such surveys of pests and disease are reported within this draft document and it is understood that no such surveys have been conducted in Australia.

PHAMA believes that this lack of survey data is a flaw within this draft document as the germplasm used to develop Australia's commercial taro industry came from the Pacific Island countries. PHAMA requests, that in light of these considerations, a full and rigorous pest and disease survey of the Australian taro industry is conducted, documented and reported to the scientific community before this review is finalised.

4.9 Taro Vein Chlorosis – Taro Vein Chlorosis Virus (TaVCV)

PHAMA notes that it is not known how the virus is transmitted. The plant hopper *Tarophagus prosperina* is suspected to be a vector (QUT 2003), although no evidence has been reported. Nor is there any data to indicate if the virus is persistent within the possible vector or not. If the virus is non-persistent, the estimates for entry, establishment and spread are too high.

4.9.1 Consequences

PHAMA notes that the overall assessment of the potential consequences (direct and indirect) of Taro vein chlorosis virus is low. This assessment is too high due to an overestimate of the direct impact of the disease on plant life or health.

It has been repeatedly noted that taro plants do not die from infection with this disease and yet the direct impact of this disease at the district level has been assessed to be a "D" or significant. An assessment of significant means that the effect on plant life or health is: "Expected to threaten the economic viability of production through a moderate increase in mortality/morbidity of hosts, or a moderate decrease in production. Expected to significantly diminish or threaten the intrinsic value of non-commercial criteria. Effects may not be reversible."

Clearly this assessment of consequence is too high as plants recover from this disease. PHAMA thinks that a value of "C" of minor significance at the district level is an accurate assessment of consequences of this disease. A value of "C" changes the overall consequences to **very low**.

4.9.2 Unrestricted Risk Estimate

PHAMA notes that the unrestricted risk for taro vein chlorosis virus is low. However, the unrestricted risk estimate should be revised to **very low** in light of suggested consequence revisions.

Pest Risk Assessment Conclusion

Detailed analysis of the draft document has identified some areas where estimates of likelihoods or consequences were overestimated. This submission provides evidence to support revised likelihoods and consequences to ensure that the PRAs are based on sound science and detailed knowledge of the pests and diseases. A summary table of risk assessment results with suggested changes in red is presented in Table 5-1, below.

Table 5-1 Summary of revised risk assessments

Pest name	Likelihood of						Consequences							URE
	Entry			Establishment	Spread	P(EES)	Direct		Indirect				Overall	
	Importation	Distribution	Overall				PLH	OE	EC	DT	IT	ENC		
Weevils [Coleoptera: Curculionidae]														
Elytroteinus subtruncatus	VL	VL	EL	VL	VL	EL	C	A	C	B	B	A	VL	N
Beetles [Coleoptera: Scarabaeidae]														
Taro beetles	VL	EL	EL	VL	N	VL	E	A	D	C	B	A	M	N
Planthoppers [Hemiptera: Delphacidae]														
Tarophagus proserpina	L	VL	VL	L	L	VL	D	A	B	B	B	A	L	VL
Fungi														
Phytophthora colocasiae	M	L	L	L	H	VL	E	A	D	B	B	B	M	VL
Viruses														
Taro vein chlorosis virus (TaVCV)	H	H	H	M	H	M	C	A	C	B	B	A	L	VL

Key:

P(EES) = overall probability of entry, establishment and spread

Likelihoods for entry, establishment and spread

N = negligible; EL = extremely low; VL = very low; L = low; M = moderate; H = high

Assessment of consequences from pest entry, establishment and spread

PLH = plant life or health; OE = other aspects of the environment; EC = eradication control etc.; DT = domestic trade; IT = international trade; ENC = environmental and non-commercial

URE = unrestricted risk estimate. This is expressed on an ascending scale from negligible to extreme

Consequence impact scores

		Geographic scale			
		Local	District	Region	Nation
Magnitude	Indiscernible	A	A	A	A
	Minor significance	B	C	D	E
	Significant	C	D	E	F
	Major significance	D	E	F	G

Pest Risk Management Measures and Phytosanitary Procedures

The suggested revisions to risk assessments provided by PHAMA would leave two viruses to be above the ALOP for fresh taro corms from PICs. These viruses will require specific pest risk management measures to reduce the restricted risk to a level that achieves Australia's ALOP if surveys are conducted within Australia and these viruses are found not to be present.

If these viruses are not present within Australia it is proposed that topping of corms of large corm taro from countries where these viruses are present is the accepted risk management measure. It is also proposed that a standardised topping procedure that would meet phytosanitary requirements is developed and demonstrated by BSG to PICs wanting to export fresh taro corms to Australia.

A standardised topping procedure would enable all exporters to meet quarantine requirements without unduly damaging corms and exposing them to additional post-harvest infestations which may pose a quarantine threat to Australia.

In addition to this proposed risk management measure PICs have implemented a substantial revision and update of taro handling, processing and packing house standards and procedures. Production and processing manuals will be developed by industry and government with the assistance of the Australian Centre for International Agricultural Research (ACIAR) and AusAID program funding. The implementation and maintenance of these standards will greatly improve the consistency of export consignments and significantly increase compliance with Australian export requirements.

PHAMA requests ongoing dialogue with BSG prior to finalisation of pest risk management measures and phytosanitary procedures to ensure that the industry standards that are developed comply with finalised taro import policy.

PHAMA acknowledges that countries that are able to demonstrate freedom from Colocasia bobone disease virus and Taro vein chlorosis virus may apply for access for small corm taro.

6.1 Topping of Corms of Large Corm Taro from Countries where Certain Pests and Diseases are Present

There is currently no standard procedure nor guidance from BSG for topping of large corm taro as a phytosanitary procedure. This has led to various interpretations of this requirement within PICs. To date this requirement has not been technically justified and has the detrimental effect of exposing the taro corms to post-harvest infections leading to additional quarantine intervention. Standardisation of this requirement through active BSG instruction in packing house and processing areas along with the introduction of export quality standards for fresh taro corms would serve to strengthen the quarantine integrity of taro corms and substantially reduce quarantine risk to Australia.

6.2 Topping of Corms of Large Corm Taro from Countries where Taro Plant Hopper is Present

PHAMA suggests that this requirement is not necessary for this pest as taro plant hopper should be revised to be below the ALOP.

6.3 Risk Management for Taro Leaf Blight Countries

PHAMA has suggested that TLB should be assessed as below the ALOP for PIC countries where the disease is present. If this assessment is not accepted by Australia and risk management measures are required, PHAMA would like to propose the following as the basis for discussion as a risk management option for fesh taro corms from countries where TLB is present:

1. The level of blight in plantations to be defined. This would be met only by resistant varieties (eg newly bred hybrids in Samoa and PNG) or traditional varieties grown in non-blight environments (eg upland areas in Pacific islands).
2. X days before harvest the leaves are cut from the plants and removed from the plantation.
3. The plants and soil adjacent to the corms are sprayed with copper fungicide. Note, Gollifer & Booth (1973) did not detect *P colocasiae* in corms from crop in Solomon Islands that had been sprayed with copper fungicide against leaf infection, whereas corm infection in unsprayed plants was high (Jackson & Gollifer (1975).
4. Suckers and roots are removed; petioles pared to 1–2 cm exposing the inner leaves.
5. Corms are washed in water to remove soil and other contaminants.
6. Corms are drenched in a X% solution of sodium hypochlorite (or equivalent disinfectant).

Further details on this proposal will be developed and supplied to BSG if risk management measures are determined to be necessary. PHAMA considers that these management measures would reduce the risk of TLB associated with fresh taro corms from PICs to below Australia's ALOP.

6.4 Policy on Unidentified Disease Symptoms

Australia continues to action diseased material where identification of the pathogens responsible is not possible despite definitive pest and disease lists for each PIC and regular and ongoing surveys conducted by PICs.

Where identification of diseased symptoms has occurred, diseases of quarantine concern have never been identified. If there are any additional diseases of concern associated with taro corms within PICs they would be detected and reported by PICs to the international community. Continued action on non-quarantinable soft rots, despite the well documented disease status of PICs is trade restrictive and precautionary. This action is not based upon the available science. PHAMA requests that dialogue is initiated to develop mechanisms to remove this unjustified action from the final policy document.

Conclusion

PHAMA has provided these comments and suggestions in the belief that there is a genuine desire for BSG to set the least trade restrictive requirements for imports of fresh taro corms, whist protecting the quarantine status of Australia. In the spirit of transparency PHAMA requests that surveys for exotic pests and diseases are conducted on Australian commercial taro stocks and reported to the scientific community, before this policy is finalised. The provision of this information will ensure that the review document is an accurate and valid assessment of risk.

Finally, PHAMA hopes that the provision of comments will be the first chapter in the development of a commercially viable PIC taro export industry to Australia. To ensure this PHAMA will be seeking ongoing dialogue with BSG prior to finalisation of this policy document.

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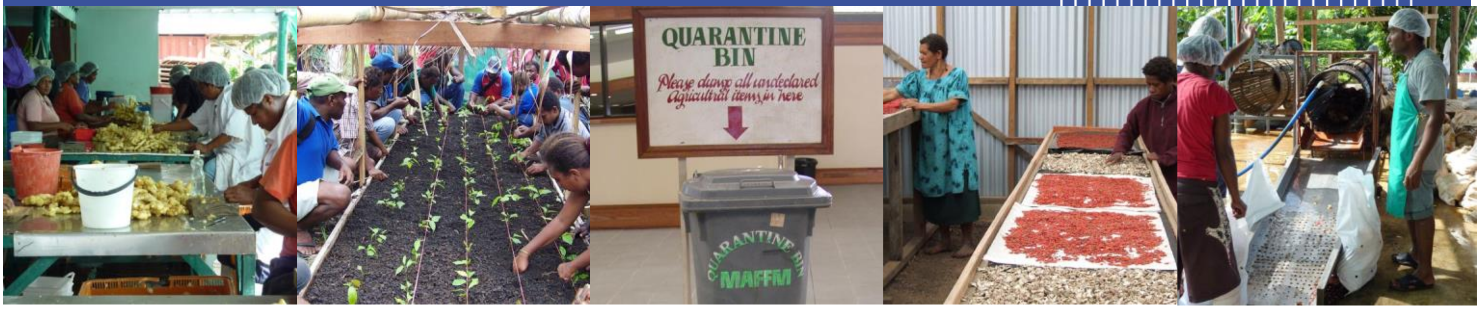

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