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CARIBBEAN AGRICULTURAL HEALTH & FOOD SAFETY AGENCY

CARIBBEAN DEVELOPMENT BANK

TARO (DASHEEN) & EDDO

GUIDELINE TO FACILITATE INTRA-REGIONAL TRADE IN THE CARIBBEAN

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REGIONAL GUIDELINES FOR
PHYTOSANITARY MEASURES

GUIDELINE TO FACILITATE INTRA-REGIONAL TRADE IN TARO (DASHEEN) & EDDO

Produced by the Caribbean Agricultural
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Adoption

This guideline was adopted by the Council of Trade and Economic Development (COTED) in June 2022.

INTRODUCTION

Scope

This guideline provides assistance to national plant protection organisations (NPPOs) within the Caribbean region in managing the risk of introduction of specific pests associated with cross-border movement of taro (*Colocasia esculenta*) and eddo (*Colocasia antiquorum*) corms and leaves intended for consumption or processing by providing clear guidance and protocols for intra-regional trade of the commodity in the Caribbean region. The guideline applies to all varieties of edible taro and eddo leaves, petioles and corms for use as food or for processing; the roots of the plant are not covered.

The major pests of taro and eddo, pests of regional priority and pests regulated by countries in the Caribbean region – and phytosanitary measures to manage these pests - are included in this guideline. Recommended measures include those that have been adopted as International Standards for Phytosanitary Measures (ISPMs) as well as those that are generally used in trade amongst Caribbean countries.

This guideline does not address issues related to living modified organisms, climate change, quality of taro and eddo leaves, petioles and corms, or diversion from intended use; trade in the whole plant, cuttings, or roots is not covered in this document.

Definitions

Definitions of phytosanitary terms used in the present guideline can be found in ISPM 5 (*Glossary of phytosanitary terms*).

OUTLINE OF REQUIREMENTS

The issue of pest risk varies within and between countries. It is therefore important for importing NPPOs to apply pest risk analysis (PRA) (see ISPM 2: *Framework for pest risk analysis* and ISPM 11*: Pest risk analysis for quarantine pests*) in the process of identifying quarantine pests and providing the technical justification for the imposition of phytosanitary import requirements. The importing country should consider equivalence of phytosanitary measures if the country of export is unable to conduct specific requests for phytosanitary measures. Such a process should be in keeping with ISPM 24 (*Guidelines for the determination of equivalence of phytosanitary measures*).

Phytosanitary certification and import regulatory systems should be in accordance with ISPM 7 (*Phytosanitary Certification System*), ISPM 12 (*Guidelines for Phytosanitary Certificates*) and ISPM 20 (*Guidelines for a phytosanitary import regulatory system*). Inspections and sampling of consignments should be in keeping with ISPM 23 (*Guidelines for inspection*) and ISPM 31 (*Methodologies for sampling of consignments*), respectively. Wood packaging materials, including pallets, used for consignments must be in conformance with ISPM 15 (*Regulation of Wood packaging material in international trade*).

This document seeks to provide guidance on procedures to establish phytosanitary import requirements. It also identifies and describes specific phytosanitary measures that may be used to reduce pest risk and it provides guidance on sampling, inspection and phytosanitary certification of taro and eddo corms, leaves and petioles for export.

BACKGROUND

Description of taro and eddo

Colocasia species are herbaceous perennial plants with a large corm on or just below the surface of the ground. The leaves are large and sagittate in shape. In its raw form, the plant is toxic due to the presence of calcium oxalate monohydrate and the presence of microscopic needle-shaped raphides in the plant cell. These features give the plant an acrid flavour but this irritant can be removed by cooking. Taro corms can remain underground and survive through unfavourable environmental conditions. Unharvested, the corms will sprout, giving rise to new

plants. Under favourable environmental conditions, the plants may continue growing for several years.

Linnaeus originally described two species, *Colocasia esculenta* and *Colocasia antiquorum*. Subsequent botanists, however, are of the view that these previously described species belong to a single, very variable species. There are many species within the genus, many of which are used as food. The corms are edible and serve as a traditional starch staple in many tropical areas.

Taro

Taro (*Colocasia esculenta*) is primarily grown as a vegetable for its edible, starchy corm. The plant has rhizomes which vary in shape and size. Leaves are large (up to 40 cm x 24.8 cm), sprout from the rhizome, are dark green above and light green beneath. Young taro leaves and petioles are also consumed as a vegetable. Taro, thought to be native to Southern India and Southeast Asia, has spread across the globe, where it is also cultivated and used as food. Taro can be grown in areas where water is abundant, inclusive of flooded conditions, but must be cool and flowing since warm, stagnant water causes basal rotting. Taro does well in deep, moist or even swampy soils. Harvesting is usually done using manual tools, even in mechanized production systems. Taro is called dasheen in the English-speaking countries of the Caribbean where it is cultivated and consumed as a staple crop in the region.

Eddo

Eddo (*Colocasia antiquorum*) is a tropical vegetable that is closely related to taro and is used mainly for its thickened stem, or corm. Like taro, the young leaves can also be consumed after cooking. It is thought that the eddo was developed as a crop in China and Japan and subsequently introduced to the West Indies. Eddoes grow best in rich loam, well-drained soil though they can tolerate poorer, drier soils and cooler temperatures when compared to taro.

Colocasia species are listed as major hosts of *Coptertermes* (termites), Dasheen Mosaic Virus (dasheen mosaic), and *Pythium myriotylum* (brown rot of groundnut). Plants in this genus are minor hosts of *Aleurodicus dugesii*, *Chrysomphalus dictyospermi* (dictospermum scale), *Cladosporium colocasiae* (ghost or false spot), *Maconellicoccus hirsutus* (pink hibiscus mealybug), *Meloidogyne incognita* (root-knot nematode), *Meloidogyne javanica* (sugarcane eelworm), *Pentalonia nigronervosa* (banaba aphid), and *Rhopalosiphum rufiabdominalis* (rice root aphid). The corms and leaves of taro and eddo moving in trade therefore have the potential to host pests that can be introduced into an importing country which could result in negative impacts on the economy.

Identity

Preferred Scientific Name
***Colocasia esculenta (L.)* Schott (1832)**
Preferred Common Name
Taro

Preferred Scientific Name
***Colocasia antiquorum* Schott**
Preferred Common Name
Eddo

Taxonomic Tree

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Subphyllum: Angiospermae
Class: Monocotyledonae
Order: Arales
Family: Araceae
Genus: Colocasia
Species: *Colocasia esculenta*

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Subphyllum: Angiospermae
Class: Monocotyledonae
Order: Arales
Family: Araceae
Genus: Colocasia
Species: *Colocasia antiquorum*

Intended Use

The guideline covers fresh taro (dasheen) and eddo leaves and corms for the intended purpose of consumption as food or for processing. Due to the close relatedness of these two commodities, this guideline will provide encompassing guidance to support intra-regional trade of taro and eddo.

REQUIREMENTS

Pest risk analysis

The NPPO of the importing country should conduct PRA associated with taro and eddo corms and leaves in accordance with ISPM 2, *Framework for pest risk analysis* and ISPM 11, *Pest risk analysis for quarantine pests*, to determine the regulatory status of the pests for the area from which the commodity originates.

Pests of Phytosanitary Significance Affecting Trade in Taro and Eddo

None of the current regional priority plant pests are known and/or confirmed to affect taro and eddo grown in the Caribbean region. Appendices 1 and 2, respectively provide combined lists of general pests and regulated pests found on taro and eddo grown in the Caribbean region.

Table 1 is a list of pests associated with fresh taro and eddo that may be identified as regulated pests requiring phytosanitary measures by the PRA process. None of these pests are known to

affect the corms. Measures in Table 3 are recommended for the management of these quarantine pests. These measures may be substituted where technically justified.

In the conduct of the pest risk assessment, significant uncertainty may be identified, making it difficult to evaluate phytosanitary measures. Cases of uncertainty do not mandate the application of measures unless it is determined that a pest is likely to be introduced and result in negative economic impacts in the PRA area.

In Table 2, included is a list of pests for which there is uncertainty in the Caribbean as to association with taro corms in trade and a description of the uncertainty.

Table 1. Pest groups associated with taro and eddo

Pest Group	Family	Example species
Aphids	Aphididae	*Pentalonia nigronervosa*
True bug	Aleyrodidae	*Crenidorsum aroidephagus* (Martin & Aguiar, 2001)
Mites	Tetranychidae	*Tetranychus tumidus* Banks
Planthoppers	Delphacidae	*Tarophagus proserpina* (Kirkaldy, 1907)
Slugs	Veronicellidae	*Veronicella cubensis* (Pfeiffer)

Table 2. Pests with uncertain association with taro corms in trade

Pest Group	Family	Pest	Description
Bacteria	Ralstoniaceae	*Ralstonia solanacearum* race 2 biovar 1	The causative agent of moko disease has been reported as affecting dasheen grown in areas infected with the bacterium. There is little or no information to support this, particularly how it affects the leaves and corms of taro (dasheen). With the possibility that taro could be asymptomatic for the disease, the commodity should be grown in fields where the pathogen is not known to be present. There are no reports of the bacterium affecting eddo, however.

General Procedures

Once technically justified, general procedures include the following:

Production:

- Registration of producers, farms and exporters and maintenance of a registry of these entities by the NPPO of the exporting country
- Application of good agricultural practices (GAP) (e.g., site and land selection, use of agrochemicals in as recommended by the manufacturer, use of pest resistant or tolerant varieties where available, farm sanitation, weed management)
- Monitoring for pests and their vectors where applicable
- Farm certification.

Packaging and grading:

- Registration of packing houses
- Development of, and compliance with, packing house requirements
- Pest management in the packing house
- Packing in new and clean material (including protective material, where required)
- Labelling of packaging
- Storage prior to export and transportation in a secure manner to prevent contamination and infestation (e.g., use of insect-proof packaging)
- Grading to ensure suitability of taro and eddo for export, including freedom from damage and/or rot, symptoms of pests and contamination with soil, plant debris and extraneous materials

Treatment facilities:

- Registration and approval of export treatment facilities (where different to the packing house) in accordance with established procedures
- Secure management to prevent contamination and infestation.

Sanitary (Food Safety) Measures

Food contamination can be caused in several ways, the main types of which are biological, chemical, physical and allergenic. Some such contamination could be due to naturally occurring contaminants in the environment or artificially introduced by certain agricultural practices.

Food contamination is a matter of serious food safety concern because high concentration of chemicals and contaminants present in food can pose serious health risks. The handling, packaging, transportation and storage of commodities intended for consumption are significant contributors to food contamination. It is therefore important that good agricultural practices and good hygiene practices are maintained from the point of production to the point of export to reduce or eliminate contamination of taro and eddo leaves, petioles and corms.

Phytosanitary Measures

There are no regional pests of quarantine significance that have been confirmed/shown to be associated with taro and eddo in the Caribbean region. Table 3 below provides information on pests associated with the leaves and petioles of taro and eddo along with measures considered to be effective in managing each pest group previously identified in Table 1.

Table 3. Phytosanitary measures considered to be effective in managing the risk from specified pest groups

Pest Group	Phytosanitary Measure(s)
Aphids	PFA[1], PFPP[2], systems approach, pre-harvest application of chlorpyrifos & acephate foliar sprays, post-harvest chemical & heat treatment
True bug	Harvest management, systems approach, visual examination
Mites	GAPs (e.g., rationalize use of soil applications of neonicotinoid insecticides and broad-spectrum insecticide applications, such as carbaryl and most pyrethroids)
Planthoppers	GAPs, harvest management, visual examination, post-harvest washing & dipping, trimming of petiole bases
Slugs	PFA, systems approach, GAPs, visual inspection

NPPOs of importing countries in the region should recognize the effectiveness of treatments to manage the target pests or provide technical justification in support of alternative measures.

[1] Pest Free Area
[2] Pest Free Places of Production

Phytosanitary measures applied to manage the risk(s) from one pest could likely also manage the risks posed by other pests of the commodity.

In the case of phytosanitary import requirements, such should be required solely for pests that countries have identified as regulated pests that require the application of phytosanitary measures thus determined by PRA for the endangered area. In cases where the association of the pest or pest group to the pathway is uncertain, phytosanitary measures should be justified through PRA.

Pest Free Areas (PFA)

Guidance on pest free areas may be sourced in ISPM 4 (*Requirements for the establishment of pest free areas*) and ISPM 8 (*Determination of pest status in an area*).

Pest Free Places of Production (PFPP) and Areas of Low Pest Prevalence (ALPP)

Guidance on pest free places of production and areas of low pest prevalence is found in ISPM 10 (*Requirements for the establishment of pest free places of production and pest free production sites*) and ISPM 22 (*Requirements for the establishment of areas of low pest prevalence*). The utility of these phytosanitary measures may be limited by some characteristics of pests.

Pre-Harvest and Harvest Management

Pre-harvest management

Crops should be managed using good agricultural practices. Plots should be kept weed free and appropriate fertilizers used where necessary. A crop rotation programme helps reduce pest incidence. Sporadic attacks of molluscs should be dealt with immediately with the use of snail and slug baits. Whiteflies and aphids, sometimes accompanied by moulds on the leaves, may be treated using insecticides and fungicides only when absolutely necessary. Chlorpyrifos and acephate foliar sprays are effective to control aphids and attendant ants. Fields should be scouted for signs of Hemiptera-vectored viral disease and appropriate action taken.

Due to the resulting rise in populations of mites on taro and eddo upon soil treatment with neonicotinoid insecticides or following application of broad-spectrum insecticides such as carbaryl and most pyrethroids, use of these in the pest management programme should be rationalized.

Harvesting

Care should be taken when removing corms from the soil since mechanical damage, even miniscule bruises and scrapes that break the protective skin, can provide a site for the entry of disease organisms, resulting in post-harvest losses due to rot. The leaves and cormels should be removed from the corms at harvest. Corms with large scars should be removed as they are unsuitable for export.

Post-harvest handling and treatments

Handling and sorting

Corms must not be thrown or dropped during handling as this would cause internal damage, resulting in spoilage. Leaves and cormels should be carefully removed at harvest. All excess soil should be removed. All rotted, soft and mechanically/insect damaged corms should be discarded. Additionally, corms should be reaped as close as possible to being transported and should be placed in a cool, shaded environment until transport arrives. Sacks can be used to remove corms from the field once heat is not allowed to build up in the bag as high temperature and humidity can lead to rapid spoilage. Field containers should preferably be rigid and not be overloaded as this may lead to compression damage to the commodity.

Fresh taro and eddo leaves must be free from rot, signs of shriveling and dehydration, and damage caused by pests. All damaged leaves must be removed and discarded. Additionally, the leaves should not include flowers, roots or other plant parts. Slugs should be excluded from the harvested leaves through visual inspection and removal.

Transportation

Vehicles used to transport leaves and corms should be clean and provide a cool environment for the produce. Records should be kept of all vehicular cleaning activities. Damage to the produce should be prevented while being loaded, transported and off-loaded, regardless of the method of transport being used to move the goods.

Cleaning

Within 4 hours of harvest, corms should be cleaned in running water to remove all soil, roots and dead tissues and excess petiole trimmed without cutting into the corm. Any water used to clean leaves and corms in this process should be clean. The degree of cleaning is dependent on the requirements of the importing country.

Curing

The wounds of corms with minimal damage can be healed when kept at ambient temperatures of 24-29ºC with 86-98% relative humidity.

Storage

Simple storage of corms can be done by burying in shaded well-drained leaf-lined soil pits for up to (4) weeks. The corms are chilling sensitive, and quality can be adversely affected when stored at 7ºC and lower. Storage at 7-13ºC and 85-90% relative humidity can further extend the life of the corms to periods of 4-6 months. However, these corms must be dry and free of soil and mechanical injury. During shipping, corms should be stored between 7 and 10ºC.

Treatments

Treatments include a range of processes that are targeted at the control or eradication of pests and contaminants from approved commodities, empty containers and export vessels. Treatments can include – but are not limited to – fumigation; irradiation; use of controlled atmosphere or temperature; application of a chemical substance; dismantling, repairing or cleaning; repacking; or blending. The choice of the treatment applied is the responsibility of the importing country, unless otherwise determined by legislation or international standards.

Specific treatments for taro and eddo may be selected and mutually agreed upon between the countries of import and export in accordance with approved international standards and treatments.

Fumigation treatment

Fumigation is the treatment with a chemical agent that reaches the commodity and target pest(s) in a gaseous state. The fumigant may be effective against all pest groups or used to target a particular pest group and may address all or most life stages. The application of fumigation as a phytosanitary treatment should be in accordance with ISPM 43 (*Requirements for the use of fumigation as a phytosanitary measure*).

Chemical treatment

Chemical treatments are used on a wide range of agricultural products from pre-planting through to post-harvest stages. These treatments are intended to destroy, repel and control pests of agricultural commodities. The chemicals are commonly applied by **dipping** (i.e., fully immersing the commodity into a solution) or spraying at a specific concentration for a specified

period, to reduce the risk of a broad range of pests in the target area or on the target commodity. Chemical treatments may also be used to destroy pests within empty holds of a vessel or container.

For export within the Caribbean region, corms may either be treated with a solution of bleach (19 ml bleach: 10 litres water) or treated with a solution of Ridomil MZ WP (2.8 g: 23 litres of water) [or other appropriate fungicide] for 5-10 seconds to prevent fungal attack. Corms should be placed on racks to allow excess solution to be drained from the corms before packing; the solution should be changed when the water becomes cloudy and discoloured.

To eliminate aphids, taro and eddo leaves may be pre-washed in mild detergent or soap solution, followed by a 5-minute dip in an insecticidal soap or soap-pyrethroid combination at the rate specified on the product label.

Temperature treatment

Temperature treatments may be used as a phytosanitary treatment option. The application of heat treatments and systems to support the treatments should be in accordance with ISPM 42 (*Requirements for the use of temperature treatments as phytosanitary measures*) and technically justified by PRA.

Vapour Heat Treatment (VHT) is the process in which water vapours are used to heat a commodity until it reaches a minimum temperature for a specified period of time to effectively control live infestations of certain pests. It is an option generally used for commodities that are resistant to high moisture and vulnerable to drying out.

Taro and eddo foliage may be immersed in hot water at 49ºC for 10 minutes to kill aphids and other external feeders that may be present.

Cold treatment involves the use of refrigerated air to lower the temperature of a product to, or below, a specific temperature for a specific period to mitigate the risks of infestations of target pests. This treatment is used primarily for fresh fruits and vegetables that are hosts of internally feeding pests. The treatment is generally commodity and pest specific.

Packing, packaging and labelling

Corms can be kept moist by wrapping in polythene and then placed in approved shipping cartons or approved containers which should be properly labelled in compliance with the importing country's requirements. Generally, the label placed on each packing container of corms or leaves should include the name and address of the packer or dispatcher, name of producer,

origin of the produce, and the net weight. Handwritten labels are discouraged. The maximum recommended weight per carton is 20 to 25 kg.

Systems Approaches

Guidance for the use in development and evaluation of integrated measures in a systems approach can be found in ISPM 14 (*The use of integrated measures in a systems approach for pest risk management*). At least two measures which are independent of each other may be used to manage specific quarantine pests and any uncertainty.

Verification of compliance

Sampling and inspection should be carried out by the NPPO to verify compliance of consignments of taro and eddo with phytosanitary import requirements.

The NPPO may authorize entities to conduct specific phytosanitary activities (e.g., sampling, inspection and testing in accordance with the ISPM 45 (*Requirements for national plant protection organizations if authorizing entities to perform phytosanitary actions*).

Sampling and phytosanitary inspection

ISPM 31 (*Methodologies for sampling of consignments*) and ISPM 23 (*Guidelines for Inspection*) may be used for official guidance on sampling and phytosanitary inspection.

In accordance with official procedures, the NPPO of the exporting country should sample and inspect each consignment of fresh taro and eddo to verify conformance with importing requirements and freedom from quarantine pests. If infield controls require the registration of the production area or farm(s), sampling and inspection should be conducted in each homogenous grower lot.

In instances where live pests are found, the exporting country NPPO should determine whether additional actions are required to meet the conditions of the importing country NPPO.

The number of packages presented for inspection should be consistent with documentation for the consignment. The documentation should certify that basic measures have been applied and that any required traceability labelling is complete. Initial inspection of the consignment should also verify that the phytosanitary security is maintained for the consignment.

Minimum sample size for inspection should be based on a 95% confidence level as set out in ISPM 31 (*Methodologies for sampling of consignments*), or as specified by the NPPO of the importing country with technical justification.

Phytosanitary certification

All commodities intended for export attain a phytosanitary status when they are produced in a PFA or PFPP; after harvest, for commodities from certified farms required to eliminate, manage or monitor specific pests; after a phytosanitary treatment, and after export inspection. A phytosanitary certificate should only be issued when the requirements of the importing country, as set out in an Import Permit issued by its NPPO, have been verified as being met as confirmed in the certifying statement. Phytosanitary certification (for export and re-export) should be in keeping with ISPM 12 (*Phytosanitary certificates*). An additional declaration may be required by the country of import to verify compliance with the import requirements as specified by the importing country's NPPO.

If a consignment of fresh taro or eddo is opened, split up or packaging changed prior to arriving in the country of import, a phytosanitary certificate for re-export is required from the re-exporting country. Re-exported consignments must be accompanied by (a copy of) the original phytosanitary certificate.

Phytosanitary certificates, and Phytosanitary Certificates for Re-export should be in accordance with ISPM 12 (*Phytosanitary certificates*).

For consignments of taro and eddo tubers for consumption to receive phytosanitary certification, the consignments must:

- Meet the specific requirements as indicated in the Import Permit issued by the importing country
- Originate only from officially approved places of production
- Be clean (i.e., practically free from viable regulated pests, and associated tissue damage, soil, chemical contaminants, or any other extraneous material and substances)
- Be treated in a manner consistent with the application standard and treatment certificate presented
- Be accompanied by pest free area declaration, where required

- Be packaged in clean and new material (including packaging material used to prevent damage during transport)
- Be exported in a secure manner to prevent contamination.

If viable regulated pests are detected, a phytosanitary certificate should not be issued unless appropriate phytosanitary measures have been applied.

Phytosanitary security

Once commodities have received phytosanitary certification, and until such commodities are exported, the phytosanitary security of the commodities must be maintained at all times. As such, the commodities must be adequately protected to prevent infestation or contamination and labelled (in keeping with the legislation and importing country requirements) to prevent substitution. Breaches of security during transport or storage disqualifies the phytosanitary status of the commodities.

Phytosanitary security is maintained:

1. when secure packaging (containers, pallets) is used and/or
2. the consignment is isolated by physical barriers, distance or insect-proof space), AND
3. appropriate measures are taken while loading export containers.

Secure packaging

Secure packaging requirements could comprise of the following:

Container level security

- The commodity is fully enclosed in a container with the lids tightly fixed to the base
- Ventilation holes or other openings are covered with insect-proof mesh that has no more than a 1.6mm diameter pore size diagonally; alternatively, ventilation holes are fully sealed.
- Vented containers having plastic liners or bags must be fully sealed. The overlapping folded edges of the plastic liner with the container lid on top would be considered fully sealed.

Pallet level security

For containers that are palletized, security would be achieved using one of the following options:

- Each pallet is fully shrink-wrapped, with the base and the top of the pallet sealed (e.g., using a sheet of cardboard), as well as all sides, to completely enclose the commodity consignment.
- Each pallet is secured with insect-proof mesh using a pallet net with no more than a 1.6 mm pore size diagonally, to include the surface area between the bottom row of the containers and the pallet.

Isolation requirements

Commodities that are not secure-packaged may be kept secure if they are isolated from all potential sources of infestation or contamination and from other goods of different or unknown phytosanitary status.

Isolation by physical barriers

Physical barriers (e.g., walls or solid structures) can be used to form a barrier to exclude pest access. This option can be applied when the commodities are stored and handled in insect-proof spaces, shipping containers, enclosed vans or cool rooms.

Isolation by distance

The phytosanitary status of consignments may be maintained by creating a minimal acceptable distance between goods of different or unknown phytosanitary status within insect-proof spaces. This can be achieved if goods are kept (i) in a cool room held at no more than 5°C and at least 0.5m from any other goods; or (ii) outside a cool room at a temperature of no less than 5°C with at least 1m separation from any other goods.

Isolation by insect-proof spaces

The phytosanitary security of a consignment can be maintained if, at all times, the goods are kept in insect-proof spaces and are kept isolated from all potential sources of infestation or contaminants, to include products of different or unknown phytosanitary status. Packhouses, treatment facilities and cool room storage doors must be suitably insect-proof through the use of double doors, automatic doors, rubber curtains, air curtains or other approved mechanism.

Loading procedures

During the loading process, it is important to maintain phytosanitary security of the consignment by ensuring the following occurs:

- Containers with vent holes and openings must be sealed, with openings no more than 1.6mm pore size diagonally (e.g., drain holes or air intakes)
- Consignments must be loaded directly into the export container
- Commodities not securely packaged and not immediately loaded must be stored securely to prevent contamination or infestation
- Personnel loading export containers must ensure that the consignments are moved from the secured area into the export containers as quickly as possible
- Consignments must not be left unsecured and loading procedures must mitigate potential infestation.

One or more methods to safeguard fresh taro and eddo against infestation after the application of a phytosanitary measure should be applied. Such methods should take into account the biological characteristics of pests and the strength of the phytosanitary measures that have been applied.

Consignments in transit

In the movement of regulated commodities within the Caribbean, such commodities may transit various countries *en route* to the country of import. Procedures to identify, assess and manage pest risks associated with consignments of these commodities which pass through a country without being imported, should be conducted in such a manner that any phytosanitary measures applied in the country of transit are technically justified and necessary to prevent the introduction into and/or spread of pests within that country. ISPM 25 (*Consignments in transit*) provides guidance for handling of consignments in transit.

Audit and compliance of the export pathway

In keeping with ISPM 20 (*Guidelines for a phytosanitary import regulatory system*), the importing country's NPPO may request an audit of specific elements of the fresh taro and eddo export system. This could relate to entities registered/approved to export as well as the

records relating to exported consignments. Verification of compliance of the consignment may be sought by the importing country in the country of export.

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This guideline refers to International Standards for Phytosanitary Measures (ISPMs). ISPMs are available on the International Phytosanitary Portal (IPP) at https://www.ippc.int/core-activities/standards-setting/ispms

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APPENDICES

Appendix 1. List of pests found on taro (dasheen) & eddo in the Caribbean region

[source: National Plant Protection Organizations of Member States]

Pest Type	Scientific name	Common name(s)	Host
Bacterium	*Erwinia caratovora (L.R. Jones) Holland*	Bacterial soft rot	Taro, eddo
Bacterium	*Xanthomonas campestris*	Black rot	Taro, eddo
Fungus	*Calonectria rigidiuscula* (Berk. & Br.) Sacc.	Die-back	Taro
Fungus	*Ceratocystis autographa* Bakshi	Die-back	Taro
Fungus	*Ceratocystis fimbriata* Ell. & Halst.	Mango blight, black rot of sweet potato, cacao wilt	Taro
Fungus	*Colletotrichum gloeosporioides* Penz	Anthracnose	Taro, eddo
Fungus	*Cylindrocladium camelliae* Venkataramani & Venkata Ram	Tea root rot	Taro
Fungus	*Cytospora* sp.	Die-back	Taro
Fungus	*Fusarium oxysporum*	Basal rot	Taro
Fungus	*Fusarium* sp.	Fusarium wilt	Taro
Fungus	*Glomerella cingulata* (Stonem.) Spauld. & Schrenk.	Anthracnose, brown blight, leaf spot	Taro
Fungus	*Guignardia citricarpa* Kiely	Citrus black spot	Taro
Fungus	*Hendersonia* sp.	Die-back	Taro
Fungus	*Lasiodiplodia theobromae*	diplodia pod rot of cocoa	Taro
Fungus	*Meliola amomiicola* Stev	Sooty mould	Taro
Fungus	*Meliola helleri* Earl	Sooty mould	Taro
Fungus	*Phomopsis* sp.	Phomopsis black rot, cucumber black rot, melon soft rot	Taro
Fungus	*Phyllosticta colocasiicola*	Slothole leaf spot	Taro
Fungus	*Pseudocercospora colocasiae*	Dasheen Leaf spot	Taro
Fungus	*Puccinia psidii* Wint.	Guava rust	Taro
Fungus	*Rhizoctonia solani (Thanatephorus cucumeris)*	various, depending on host	Taro
Fungus	*Rhizoctonia* sp.	Damping off, root rot	Taro
Fungus	*Sporidesmium tropicale* Ellis	Leaf blight	Taro
Fungus	*Valsa eugeniae* Nutman & Roberts	Die-back	Taro
Insect	*Aleurodicus dispersus*	Spiralling whitefly	Taro
Insect	*Aphis craccivora (Koch)*	Cowpea aphid	Taro, eddo
Insect	*Aphis gossypii* Glover	Melon aphid, cotton aphid	Taro, eddo
Insect	*Aspidiotus destructor*	Coconut scale	Taro
Insect	*Bemisia tabaci* (Gennadius)	sweet potato whitefly	Taro, eddo
Insect	*Corythuca gossypii* (F.)	Cotton (bean) lacebug	Taro, eddo
Insect	*Cylas formicarius*	Sweet potato weevil	Taro
Insect	*Dysmicoccus brevipes* Cockerell	Pineapple mealybug	Taro

Pest Type	Scientific name	Common name(s)	Host
Insect	*Ferrisia virgata* Cockerell	Striped mealybug	Taro
Insect	*Junonia genoveva* Stoll	Tropical buckeye caterpillar	Eddo
Insect	*Ligyrus ebenus*	Dasheen beetle	Taro
Insect	*Ligyrus ebenus* (Degeer)	Black sugarcane chafer	Taro, eddo
Insect	*Myzus persicae* Sulzer	Green peach aphid	Taro
Insect	*Parasaissetia nigra* Nietner	Pomegranate scale	Taro
Insect	*Pentalonia nigronervosa* Coquerel	Banana aphid	Taro
Insect	*Phyllophyga* spp.	Eddo grub	Eddo
Insect	*Pinnaspis strachani* Cooley	Lesser snow scale	Taro
Insect	*Planococcus citri*	Citrus mealybug	Taro
Insect	*Pseudococcus longispinus* Targioni Tozzetti	Long-tailed mealybug	Taro
Insect	*Scirtothrips dorsalis*	Chilli thrips	Taro
Insect	*Sitophilus zeamais* Motschulsky	Greater grain weevil	Taro
Insect	*Tetraleurodes* sp.?	Whitefly	Taro
Insect	*Tetraleurodes ursorum* (Ckll.)	Bearberry whitefly	Taro, eddo
Insect	*Vinsonia stellifera* (Westwood)	Star scale	Taro, eddo
Mite	*Tetranychus* spp.	Spider mite	Taro, eddo
Mollusc	*Veronicella sloanei* (Cuvier)	Pancake slug	Taro, eddo
Nematode	*Helicotylenchus dihystera*	Common spiral nematode	Taro
Nematode	*Helicotylenchus multicinctus* (Cobb & Golden)	Spiral nematode	Taro, eddo
Nematode	*Helicotylenchus* spp.	Spiral nematodes	Taro, eddo
Nematode	*Meloidogyne* spp.	Root knot nematode	Taro, eddo
Nematode	*Pratylenchus* coffeae	Banana root nematode	Taro
Nematode	*Rotylenchulus reniformis* Linford & Oliveira	Reniform/Spiral nematodes	Taro
Nematode	*Tetranychus* sp.	Spider mites	Taro, eddo
Oomycete	*Phytophthora cinamomi* Rands	Root rot of avocado	Taro
Oomycete	*Phytophthora colocasiae*	Taro blight	Taro
Oomycete	*Phytophthora* spp.	Corm and root rots	Eddo
Oomycete	*Pythium debaryanum*	Damping-off	Taro
Oomycete	*Pythium myriotylum*	Root and Stem Rot	Taro
Oomycete	*Pythium* spp.	Corm and root rots	Eddo
Virus	Cucumber mosaic virus	Cucumber mosaic	Taro
Virus	*Dasheen mosaic potyvirus*	Dasheen Mosaic Virus	Taro
Virus (?)	*?*	Chlorotic streak (virus?)	Taro
Weed	*Emilia sonchifolia*	Consumption weed	Taro
Weed	*Synedrella nodiflora*	Cinderella weed	Taro

Appendix 2. List of pests of taro (dasheen) & eddo regulated by countries in the Caribbean region

[Source: National Plant Protection Organisations of Member States]

Pest Type	Scientific name	Common name(s)	Host
Insect	*Crenidorsum aroidephagus* (Martin & Aguiar)	Anthurium whitefly	
	Pentalonia nigronervosa	Banana aphid	
	Tarophagus proserpina (Kirkaldy, 1907)	Taro leafhopper	Taro
Mite	*Tetranychus tumidus* Banks	Tumid spider mite	All
Mollusc	*Veronicella cubensis* (Pfeiffer)	Two-striped slug	Taro