Agenda Item 7 CX/NASWP 23/16/7

November 2022

**JOINT FAO/WHO FOOD STANDARDS PROGRAMME**

**FAO/WHO COORDINATING COMMITTEE FOR North America and the South West Pacific**

**Sixteenth Session**

**Suva, Fiji**

**30 January - 3 February 2023**

**Draft regional standard for fermented noni fruit juice**

**(at Step 7)**

(Prepared by the Electronic Working Group chaired by Tonga and co-chaired by Samoa)

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| Codex Members and Observers wishing to submit comments, at Step 6, on this draft (Appendix I) should do so as instructed in CL 2022/XX/OCS-NASWP available on the Codex webpage/Circular Letters 2022 |

1. **Background**

***Draft Standard***

## In June 2019, the 15th Session of the FAO/WHO Regional Coordinating Committee for North America and South West Pacific (CCNASWP15) agreed to:

* forward the proposed draft regional standard for fermented noni fruit juice (draft Standard) to CAC43 for adoption at Step 5;
* forward the relevant draft provisions for endorsement to the respective committees as follows:
  + Codex Committee on Food Additives (CCFA),
  + Codex Committee on Food Labelling (CCFL) and
  + Codex Committee on Methods of Analysis and Sampling (CCMAS);
* request Joint FAO/WHO Expert Committee on Food (JECFA) to retain scopoletin on the priority list and to call upon Member countries to generate and submit data to support the conduct of the safety evaluation;
* convene an EWG, to be chaired by Tonga and co-chaired by Samoa and working in English only, to further advance the draft regional standard taking into account the discussions at CCNASWP15 for consideration at CCNASWP16.

## The food additive and food labelling provisions in the draft standard were endorsed respectively at CCFA52 (September, 2021) and at CCFL46 (October, 2021).

## CCMAS41 (May, 2021) however did not endorse:

* The AOAC 983.17/ EN 12143/ IFUMA 8/ ISO 2173 as the appropriateness of extending the methods to fermented noni fruit juice needed further evaluation by CCMAS; but noted the offer of the international fruit and vegetable juice association (IFU) to do a small single or inter-laboratory study to determine its fitness for purpose in fermented noni fruit juice;
* The methods for the identification of scopoletin and deacetylasperulosidic acid but noted that changes needed to be made to the methods to give a clear indication of the solid phase extraction separation mode needed and agreed to request CCNASWP to provide clarification. CCMAS41 agreed to inform CCNASWP accordingly.

## In advising CCNASWP, CCMAS41 noted that the lack of endorsement was not because the information provided was incorrect, rather that clarification was needed to provide the confidence in the method to enable CCMAS to endorse it.

## CAC43 (December 2021) adopted the draft regional standard for fermented noni fruit juice at Step 5.

***Progress on submitting data to JECFA for safety evaluation***

## CCNASWP15 agreed to request the Codex Committee on Contaminants Food (CCCF) to retain scopoletin on the priority list and to call upon Codex members to generate and submit data to support the conduct of the safety evaluation by JECFA. CCNASWP15 also requested FAO and WHO to organize a new call for data for the safety evaluation of scopoletin. FAO reminded that a full dataset including exposure and toxicity is required. CCCF14 (2021) agreed to keep scopoletin in the priority list awaiting feedback from CCNASWP16 (2023) on the provision of necessary data and studies for JECFA to perform the evaluation of scopoletin and to encourage Codex Members to generate and submit data to GEMS/Food to support the safety evaluation by JECFA. CCCF15 did not discuss scopoletin awaiting the outcomes of the discussion at CCNASWP16 (2023) on the regional standard for fermented noni fruit juice based on the outcomes of a consultant’s report on the findings of the toxicological data review of scopoletin.

## In response to the call for data, Samoa led a workstream to generate data to support the submission to JECFA on the conduct of the safety evaluation. As well as gathering, testing and analysing Samoa’s data, they also encouraged other Member countries to send their fermented noni fruit juice samples to the Scientific Research Organisation of Samoa (SROS) for testing and analysis. Further PHAMA-Plus[[1]](#footnote-2) provided funding support for the transportation of the samples to Samoa[[2]](#footnote-3).

1. **EWG process**

## Invitations to join the e-WG for the draft standard were disseminated in December 2021 with a deadline for response by 1 February 2022. 11 Member countries responded[[3]](#footnote-4).

## The revised draft standard (at step 6), incorporating the discussion at CCNASWP16, was posted on the e-Forum Platform on 3 March 2022 with comments due 11 April 2022. Five countries responded[[4]](#footnote-5).

## Following compilation of comments and incorporation into a second draft, the revised draft was posted on the e-Forum Platform on 7 July 2022 with comments due 1 August 2022. Three countries responded including Australia, Canada, and New Zealand.

## Compilation of comments and incorporation into a third draft followed for submission to the Codex Secretariat for circulation (via circular letter) to all Members and Observers of CCNASWP for comments ahead of CCNASWP16.

1. **Issues considered**

## The Draft Regional standard for Fermented Noni Fruit Juice has been revised to address the following issues as well as other comments from Australia, Canada, New Zealand, Tonga and United States of America:

1. *Fermentation period of Noni Fruit Juice*. One country questioned whether the fermentation period could have an effect on the level of scopoletin and therefore have the potential to raise the level of scopoletin to unsafe levels. If this was found to be the case consideration of the inclusion of an appropriate “fermentation period” in the draft standard would be warranted. However, countries have since advised that this issue has already been raised and without data to support what an optimal fermentation period might be, it was difficult to reach a decision on standardization. CCNASWP15 members were reminded that the standard should only include what is necessary and not as guidance. An appropriate fermentation could be added subsequently if it is found that there is a detrimental relationship between the fermentation period and the level of scopoletin.
2. *Key aspects of the methods of analysis section* have been clarified (including related appendixes). Information on how testing and analysis is currently undertaken for export would strengthen the draft Standard (for example information on which type of SPE cartridges are currently used in the solid phase and what is the volume of water and methanol used. This information would help provide the confidence to CCMAS to endorse the draft Standard therefore the relevant section (refer Annex A, Section 1) has been left in square brackets. [OR IF SAMOA ENDORSE 2.5 mls Remove [ ].
3. *Appropriate method of analysis* in identifying scopoletin and deacetylasperulosidic acid. Thin layer chromatography (TLC) has been previously selected by CCNASWP15 as an appropriate method and it has taken some time, and effort to get the draft Standard to this point. The TLC method has now been updated to provide a greater level of specification (refer Annex A, Section 3.1).
4. High-performance liquid chromatography (HPLC) has been suggested by member countries to be quite satisfactory due to the fact that it is fast, reproducible, reliable and less prone to operator bias (and a possible alternative to TLC).
5. The use of the HPLC method however has not yet been established for fermented noni fruit juice and a substantial piece of work required before CCMAS are likely to have full confidence in the use of this method for fermented noni fruit juice. It is proposed therefore that the TLC method should be retained and the less substantial efforts made to complete the level of specification required for CCMAS to have a level of comfort.
6. In the interim the HPLC method should be also retained in the draft Standard, as a place holder, until the more substantial additional work on the method is completed to the satisfaction of CCMAS.
7. **Recommendations**

CCNASWP16 is invited to:

1. Note that the Draft Regional Standard for Fermented Noni Fruit Juice (draft Standard) provides that scopoletin levels should be kept as low as technologically feasible until a safe level is established by JECFA.
2. Note: that ……CCNASWP is requested by CCMAS to provide clarification on the methods for the identification of scopoletin and deacetylasperulosidic acid in terms of a clear indication of the solid phase extraction separation mode. Therefore one more bullet point is needed to address this matter. [Secretariat question]
3. Note that the process of collecting, testing and analysing samples of fermented noni fruit juice has begun and inform CCCF accordingly. Once all interested member countries in the South West Pacific (SWP) region have contributed to the data package, it will be submitted to JECFA for assessment. The resulting assessment is intended to inform the draft Standard) (or adopted standard, as relevant).
4. Consider and endorse the Draft Regional Standard for Fermented Noni Fruit Juice at Step 8 (as presented in Appendix I)

**Appendix I**

This version includes:

* Changes recommended by the eWG up to June 2019;
* Comments from the eWG in response to three rounds of consultation on the e-Forum Platform.

**DRAFT REGIONAL STANDARD FOR FERMENTED NONIFRUIT JUICE**

# SCOPE

This standard applies to fermented noni fruit juice, as defined in Section 2 below, which is used as a food or food ingredient. This standard does not apply to non-fermented juice of noni fruit or other noni products from fruit, leaves, bark or flowers or noni products for medicinal purposes.

# DESCRIPTION

## Product Definition

The fermented noni fruit juice is the juice product that is derived from the fermenting of fresh fruits of noni plants[[5]](#footnote-6), *Morinda citrifolia* L. variety *citrifolia[[6]](#footnote-7)* of the Rubiaceae family.

## Noni Fruits

Fresh, firm and mature to ripe noni fruits, with greenish-yellow to white colour, are harvested, washed and left to dry. Optionally, the fruits may be crushed to a pulp (excluding seeds). Fruits that are: over-ripe, fallen fruits, green, bruised and or damaged fruit, or foreign material such as sticks, stem, leaves, bark and root material should be rejected and not used in the production of fermented noni fruit juice.

## Fermentation of Noni Fruit Juice

Whole fruits or fruit pulp are fermented spontaneously or by starter culture. Juice is extracted from the fermented products. The resultant 100% fermented noni fruit juice is pasteurized or otherwise treated to eliminate pathogens of public health significance.

**3. ESSENTIAL COMPOSITION AND QUALITY FACTORS**

## Ingredients

The fermented noni fruit juice as defined in section 2.

## Fermented noni fruit juice

* + 1. Brix value (soluble solids) 5.5° minimum

b) pH 3.5-3.9

1. Ethanol less than 0.5% v/v
2. Deacetylasperulosidic acid Present
3. Scopoletin Present[[7]](#footnote-8)

## Definition of defects

# FOOD ADDITIVES

No additives are permitted in the product as defined by the scope.

# CONTAMINANTS

The products covered by this standard shall comply with the Maximum Levels for contaminants that are specified for the product in the *General Standard for Contaminants and Toxins in Food and Feed* (CXS 193- 1985); and the Maximum Residue Limits for pesticides established by the Codex Alimentarius Commission.

# HYGIENE

It is recommended that the products covered by the provisions of this standard be prepared and handled in accordance with appropriate sections of the *General Principles of Food Hygiene* (CAC/RCP 1-1969), and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

The product should also comply with any microbiological criteria established in accordance with the *Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods* (CXG 21- 1997).

# PACKAGING

The fermented noni fruit juice products must be packed in containers that safeguard its hygienic, and organoleptic quality. The materials used for packaging must be new (for the purposes of this standard, this includes recycled material of food-grade quality.) The containers shall meet the quality, hygiene, ventilation and resistance characteristics to ensure suitable handling, shipping and preserving of the fermented noni fruit juice. Packages must be free of all foreign matter and smell.

# WEIGHTS AND MEASURES

## Fill of the container

* + 1. **Minimum fill**

The container should be well filled with the product and the product shall occupy not less than 90% of the water capacity of the container. The water capacity of the container is the volume of distilled water at 20°C which the sealed container will hold when completely filled.

# LABELLING

The products shall be labelled in accordance with the *General Standard for the Labelling of Prepackaged Food*

(CXS 1-1985).

## 8.1 Name of the product

The name of the food product shall be “Fermented Noni Fruit Juice”. The term “noni fruit juice” may be replaced by a term which has customarily been used to describe the product in the country in which the product is intended to be sold (e.g., “nonu juice” or “nono juice”).

# METHODS OF ANALYSIS AND SAMPLING

For checking the compliance with this standard, the methods of analysis and sampling contained in the Recommended Methods of Analysis and Sampling (CXS 234-1999) relevant to the provisions in this standard, shall be used.

## 10.1 Methods of Analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Provision** | **Method** | **Principle** | **Type** | **Notes** |
| Brix value (Soluble solids) | AOAC 983.17  EN 12143  IFUMA 8  ISO 2173 | Refractometry | I | Adopted for fruit juices and nectars |
| pH value | NMKL 179 / AOAC 981.12 | Potentiometry | II | Adopted for fruit juices and nectars |
| Ethanol | IFUMA 52  AOAC2017.07 | Enzymatic determination | IV |  |
| AOAC Method2016.12 | Headspace GC-FID | IV |  |
| Identification of scopoletin | Annex A\* | Thin layer chromatography (TLC) or,  High-performance liquid chromatography (HPLC) | IV |  |
| Identification of deacetylasperulosidic acid | Annex B\* | Thin layer chromatography (TLC) or,  High-performance liquid chromatography (HPLC) | IV |  |

*\* In compliance with the general criteria for testing laboratories laid down in ISO/IEC Guide 17025:2017*

## 10.1 Methods of Analysis [OR RICHARD SHOULD THIS TABLE BE USED]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Provision** | **Method** | **Principle** | **Type** | **Notes** |
| Brix value (Soluble solids) | AOAC 983.17  EN 12142  IFUMA 8  ISO 2173 | Refractometry | I | Adopted for fruit juices and nectars |
| pH value | NMKL 179 | Potentiometry | II | Adopted for fruit juices and nectars |
| Ethanol | IFUMA 52  ~~AOAC2017.12~~ | Enzymatic determination | IV |  |
| AOAC 2017.12 | Enzymatic determination | IV |  |
| AOAC Method 2016.12 | Headspace GC-FID | IV |  |
| Identification of scopoletin | Annex A\* Section 1, & 2.1 | Thin layer chromatography  ~~HPLC~~ | IV |  |
|  | Annex A\* Section 1, & 2.2 | HPLC | IV |  |
| Identification of deacetylasperulosidic acid | Annex B\* Section 1, & 2.1 | Thin layer chromatography  ~~HPLC~~ | IV |  |
|  | Annex B\* Section 1, & 2.2 | HPLC | IV |  |

*\* In compliance with the general criteria for testing laboratories laid down in ISO/IEC Guide 17025:2017*

**ANNEX A**

**IDENTIFICATION OF SCOPOLETIN**

1. **PREPARATION OF SAMPLES**

Noni juice is filtered through a 0.45 μm membrane filter and then purified by solid-phase extraction (SPE) with Waters OASISS® extraction cartridges, or similar solid-phase extraction cartridge. [SPE cartridges (specify type of cartridge in terms of solid phase) is first equilibrated with water (2-5 mls), followed by methanol (2-5 mls). The samples are then loaded onto the cartridge and washed with 5% (2-5 mls) MeOH, followed by 100% (2-5 mls) MeOH. The MeOH eluate is retained for TLC analysis.]

# PREPARATION OF REFERENCE STANDARD

* 1. A reference standard is prepared by dissolving 1 mg scopoletin in 1 milliliter of methanol.
  2. Alternately, certified *Morinda citrifolia* reference plant material may be prepared in the same manner as the samples to be analyzed. The certified *Morinda citrifolia* reference material should be from the same part of the plant as the samples to be analyzed.

# IDENTIFICATION

* 1. **THIN LAYER CHROMATOGRAPHY**

Spot 5 microliters of sample solutions and reference standard solution on a silica gel 60 F254 thin layer chromatography (TLC) plate, previously dried at 110 °C for 15 minutes in a drying oven. Develop the plate with a mobile phase of dichloromethane:methanol (19:1, v/v). View bright fluorescent blue colours on developed plate under UV lamp, 365 nm. Identify scopoletin in samples by comparing Rf values and colours to the standard.

* 1. **HIGH PERFORMANCE LIQUID CHROMATOGRAPHY**

*Preparation of samples for HPLC identification test*

For the HPLC analysis of analytes, 1 mL of noni fruit juice mixed with 1 mL of MeOH, vortex for 1 min, and prepared into a concentration of 0.5 mL/mL solution. All samples were filtered through a nylon microfilter (0.45 µm pore size) before HPLC analysis.

*Chromatographic system and HPLC identification test*

Examine scopoletin peak of the Sample solution compared to that of the Standard solution using HPLC/Photodiode-Array Detector (PDA) [Waters 2690 separations module coupled with 996 a photodiode array (PDA) detector or equivalent], equipped with an C18 column [Atlantis 4.6 mm x 250 mm; 5 µm, Waters Corporation, Milford, MA, USA or equivalent] with column temperature maintained at 25 °C. The pump connected to a mobile phase system composed of three HPLC grade solvents: A; acetonitrile (MeCN), B; Methanol (MeOH), and C; 0.1% trifluoroacetic acid (TFA)% in H2O (v/v). The mobile phase programmed consecutively in linear gradients as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Time (mins) | % Solvent A | % Solvent B | % Solvent C |
| 0 | 10 | 10 | 80 |
| 15 | 20 | 20 | 60 |
| 26 | 40 | 40 | 20 |
| 28-39 | 50 | 50 | 0 |
| 40-45 | 10 | 10 | 80 |

The elution run at a flow rate of 1.0 mL/min. The PDA detector measurements at 365 nm, and monitoring UV spectra 210-400 nm taken at various points across the observed sample peak (for purity) and checking against standard. The injection volume was 50 µL for each of the sample solutions.

*[Suitability requirements*

*Retention or Capacity factor (k′): Not less than (NLT) 5 determined from the scopoletin peak,*

*where k′ = (tR – t0)/ t0*

*tR = Retention time of DAA; t0 = Retention time of solvent front*

*Tailing or Symmetry factor (AS): NMT 2.0 for the scopoletin peak*

*where AS = W0.05/2f*

*W0.05 = with of the peak at 5% height;*

*f = distance from the peak maxima to leading edge of peak.*

*Relative standard deviation: NMT 5.0%.]*

*HPLC identification test – acceptance criteria*

The [system suitability requirements met], and retention time [± 0.1 min {only if sample and standard matrix matched} plus UV spectra taken at various points across the chromatographic peak] of scopoletin of the Sample solution corresponds to that of the Standard solution*.*

# REFERENCES

1. Deng S, West BJ, Jensen J. A Quantitative Comparison of Phytochemical Components in Global Noni Fruits and Their Commercial Products. Food Chemistry 2010, 122 (1): 267-270.
2. Potterat O, et al. Identification of TLC markers and quantification by HPLC-MS of various constituents in noni fruit powder and commercial noni-derived products. Journal of Agricultural and Food Chemistry 2007, 55(18):7489–7494.
3. Basar S, Westendorf J. Identification of (2E, 4Z, 7Z)-Decatrienoic Acid in Noni Fruit and Its Use in Quality Screening of Commercial Noni Products. Food Analytical Methods 2011, 4(1):57-65. DOI: 10.1007/s12161- 010-9125-9.
4. Chan-Blanco Y, et al. The ripening and aging of noni fruits (*Morinda citrifolia* L.): microbiological flora and antioxidant compounds. Journal of the Science of Food and Agriculture 2007, 87:1710 – 1716.
5. West BJ, Deng S. Thin layer chromatography methods for rapid identity testing of *Morinda citrifolia* L. (noni) fruit and leaf. Advance Journal of Food Science and Technology 2010, 2(5):298-302.
6. United States Pharmacopeia (2022). General Chapter, 〈621〉 Chromatography. USP-NF. Rockville, MD: United States Pharmacopeia
7. SANTE/11312/2021 Analytical Quality Control and Method Validation Procedures for Pesticide Residues Analysis in Food and Feed

**ANNEX B**

**IDENTIFICATION OF DEACETYLASPERULOSIDIC ACID**

1. **PREPARATION OF SAMPLES**

Noni juice is filtered through a 0.45 μm membrane filter and then purified by solid-phase extraction (SPE) with Waters OASISS® extraction cartridges, or similar solid-phase extraction cartridge. [SPE cartridges (specify type of cartridges in terms of solid phase) is first equilibrated with water (2-5 mls), followed by methanol (2-5 mls). The samples are then loaded onto the cartridge and washed with 5% MeOH (2-5 mls), followed by 100% MeOH(2-5 mls). The MeOH eluate is retained for TLC analysis.]

# PREPARATION OF REFERENCE STANDARD

* 1. A reference standard is prepared by dissolving 1 mg deacetylasperulosidic acid in 1 milliliter of methanol.
  2. Alternately, certified *Morinda citrifolia* reference plant material may be prepared in the same manner as the samples to be analyzed. The certified *Morinda citrifolia* reference material should be from the same part of the plant as the samples to be analyzed.

# IDENTIFICATION

* 1. **THIN LAYER CHROMATOGRAPHY**

Spot 5 microliters of sample solutions and reference standard solution on a silica gel 60 F254 thin layer chromatography (TLC) plate, previously dried at 110 °C for 15 minutes in a drying oven. Develop the plate with a mobile phase of dichloromethane: methanol: water (13:6:1, v/v/v). Spray developed plate with 2% anisaldehyde */* 10% sulfuric acid-EtOH solution then heat in oven at 110 °C for 1 minute to reveal blue colour. Identify deacetylasperulosidic in samples by comparing Rf values and colours to the standard.

* 1. **HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC)**

*Preparation of samples for HPLC identification test*

One gram of the fresh fruit juice diluted with 5 mL of H2O-MeOH (1:1), and mixed thoroughly; the solution collected into a 5 mL volumetric flask, mixed thoroughly and then filtered through a 0.2 µm PTFE filter for HPLC analysis.

*Chromatographic system and HPLC identification test*

Examine the deacetylasperulosidic acid peak of the Sample solution compared to that of the Standard solution using HPLC/Photodiode-Array Detector (PDA), [Waters 2690 separations module coupled with 996 PDA detectors or equivalent], equipped with a C18 column - 4.6 mm x 250 mm; 5 μm, [Waters Corporation, Milford, MA, USA or equivalent] with column temperature maintained at 25ºC. Elution with two mobile phases (HPLC grade), acetonitrile (MeCN), and 0.1% formic acid in water (v/v), with a flow rate of 0.8 mL/min and a linear gradient of 100% aqueous formic acid (0.1%) for 0-5 min, followed by 70% aqueous formic acid and 30% MeCN for 40 min. The PDA detector measurements at [235 nm], and monitoring UV spectra 210-400 nm taken at various points across the observed sample peak (for purity) and checking against standard. The injection volume of 10 µL for each of the Sample solution and Standard solution.

*[Suitability requirements*

*Retention or Capacity factor (k′): Not less than (NLT) 5 determined from the deacetylasperulosidic acid peak,*

*where k′ = (tR – t0)/ t0*

*tR = Retention time of DAA; t0 = Retention time of solvent front*

*Tailing or Symmetry factor (AS): NMT 2.0 for the deacetylasperulosidic acid peak*

*where AS = W0.05/2f*

*W0.05 = width of the peak at 5% height;*

*f = distance from the peak maxima to leading edge of peak.*

*Relative standard deviation: NMT 5.0%.]*

*HPLC identification test – acceptance criteria*

The [system suitability requirements met], and retention time [± 0.1 min {only if sample and standard matrix matched} plus UV spectra taken at various points across the chromatographic peak] deacetylasperulosidic acid of the Sample solution corresponds to that of the Standard solution*.*

# REFERENCES

1. Potterat O, et al. Identification of TLC markers and quantification by HPLC-MS of various constituents in noni fruit powder and commercial noni-derived products. Journal of Agricultural and Food Chemistry 2007, 55(18):7489–7494.
2. Deng S, et al. Determination and comparative analysis of major iridoids in different parts and cultivation sources of *Morinda citrifolia*. Phytochemical Analysis 2011, 22(1):26-30.
3. West BJ, Deng S. Thin layer chromatography methods for rapid identity testing of *Morinda citrifolia* L. (noni) fruit and leaf. Advance Journal of Food Science and Technology 2010, 2(5):298-302
4. United States Pharmacopeia (2022). General Chapter, 〈621〉 Chromatography. USP-NF. Rockville, MD: United States Pharmacopeia
5. SANTE/11312/2021 Analytical Quality Control and Method Validation Procedures for Pesticide Residues Analysis in Food and Feed

1. PHAMA-Plus provides practical and targeted assistance to help Pacific island countries manage regulatory aspects associated with exporting primary and value-added products [↑](#footnote-ref-2)
2. At the time of writing Samoa had received product samples from Tonga and was anticipating samples would be received from Vanuatu, Cook Islands, ?Fiji, and ?Papua New Guinea. [↑](#footnote-ref-3)
3. The countries included Australia, Canada, Cook Islands, Fiji, New Zealand, Papua New Guinea (PNG), Samoa, Solomons, Tonga, United States of America and Vanuatu. [↑](#footnote-ref-4)
4. These countries included Australia, Canada, New Zealand, Tonga, and the United States of America. [↑](#footnote-ref-5)
5. Common names of noni are great morinda, beach mulberry, Indian mulberry, ach, mengkudu, nono, nonu, noni and cheesefruit. [↑](#footnote-ref-6)
6. Two types of large fruits with oval leaves and small fruits with elongated leaves (Wagner, Herbst and Sohmer, 1990, “*The Manual of the Flowering Plants of Hawaii”* (Copyright 1990, Bishop Museum, Honolulu). [↑](#footnote-ref-7)
7. *Scopoletin is present naturally in fermented noni fruit juice. Some reports have shown potential toxicity of scopoletin. Therefore, the scopoletin levels should be kept as low as technologically feasible until a safe level is established by JECFA.* [↑](#footnote-ref-8)