

## PESTICIDES RESIDUES IN SPICES

*The first draft was prepared by Professor Arpad Ambrus, Hungarian Food Chain Safety Office, Budapest Hungary*

### EXPLANATION

Establishing of maximum residue limits for spices was discussed by the CCPR at several occasions.

The 36<sup>th</sup> Session of CCPR decided (Alinorm 04/24A) to schedule the JMPR to review the monitoring data available for the elaboration of MRLs on spices for pesticides already in the Codex system. The Committee also recommended that governments and the spice trade industry continue to collect monitoring data for pesticides on spices on a regular basis, following agreed criteria and other JMPR guidelines on the conduct of selective surveys, in order to keep the database updated for future review.

Subsequently the 2004 JMPR developed the general principles for evaluation of monitoring data for recommending maximum residue levels, median and high residues depending on the number of residue data available for a given pesticide residue and commodity combination.

The Meeting recommended among others that:

- when no sample contained detectable residues the highest reported LOQ value was used as the maximum residue level and the high residue value. The median residue value was calculated from the reported LOQ values.
- when > 120 samples contained detectable residues, the sample size was sufficiently large to calculate the upper 95% one-tailed confidence limit of the 95th percentile of the population of residues, which should be used as maximum residue level.
- monitoring results should not be used for estimating maximum residue levels that reflect post-harvest use.

Detailed guidance on submission of monitoring data and designing selective field surveys for obtaining residue data in/on spices are given in the FAO Manual Chapter 3.6.

Based on the elaborated principles, the 2004 JMPR recommended maximum residue, median and high residue levels for roots and rhizomes (HS01193) and fruits and berries (HS0191) groups for a number of pesticides. Based on the monitoring data submitted by Thailand, the 2010 JMPR recommended additional maximum, median and high residue levels for a number of pesticide residues in/on fruit, berry, root and rhizome spices.

In accordance with the decision of the 46<sup>th</sup> Session of the CCPR, India submitted monitoring data from 2009-2014 for acetamiprid, imidacloprid, carbofuran, cypermethrin, lambda-cyhalothrin, phorate, profenofos and triazophos residues in fruit/berry (cardamom, black pepper) spices, and seed spices (cumin, fennel and coriander).

### METHODS OF RESIDUE ANALYSIS

#### *Cardamom and pepper*

Blend cardamom/pepper sample (250 g) into a coarse powder. Water is added to a representative test portion and mixed. After addition of acetonitrile and mixing, the material was placed in the freezer at -18 °C for 20 minutes. The sample was then treated with NaCl, shaken and then centrifuged. The supernatant organic layer was treated with Na<sub>2</sub>SO<sub>4</sub>, vortexed and centrifuged. The subsequent supernatant was then treated with PSA sorbent and anhydrous MgSO<sub>4</sub>, vortexed and centrifuged. The supernatant was divided into two, one for LC-MS/MS and the other for GC analysis. The pesticide residues detected in GC are confirmed by GC-MS.

*Seed spices*

Modified QuEChERS multiresidue method was adopted for the extraction and clean-up of various pesticide residues from seed spices. A representative portion ground seed (20 g) was moistened with water followed by addition of acetonitrile. The extract was treated with sodium chloride for separation of acetonitrile layer which was then subjected to dispersive SPE clean-up using PSA, MgSO<sub>4</sub> and C<sub>18</sub>. The residues were determined using GC-MS/MS and/or LC-MS/MS.

The recovery and limit of quantification (LOQ) of pesticides on spices are given in Table-1.

Table 1 Recovery and limit of quantification (LOQ) of pesticides in spices

Compound	Commodity	Spike level (mg/kg)	Recovery range (%)	LOQ (mg/kg)
Acetamiprid	Cardamom	0.1-1.0	84 -103	0.1
	Pepper	0.1-1.0	88-100	0.1
	Cumin, Coriander, Fennel	0.1-1.0	88-112	0.1
Imidacloprid	Cardamom	0.1-1.0	71-83	0.1
	Pepper	0.1-1.0	81-93	0.1
	Cumin, Coriander, Fennel	0.1-1.0	93-109	0.1
Carbofuran	Cardamom	0.1-1.0	88-94	0.1
	Pepper	0.1-1.0	80-94	0.1
	Cumin, Coriander, Fennel	0.1-1.0	94-99	0.1
Cypermethrin	Cardamom	0.1-1.0	89-100	0.1
	Pepper	0.1-1.0	84-98	0.1
Lambda-cyhalothrin	Cardamom	0.1-1.0	91-102	0.1
	Pepper	0.1-1.0	95-107	0.1
Profenofos	Cardamom	0.1-1.0	93-105	0.1
	Pepper	0.1-1.0	94-108	0.1
	Cumin, Coriander, Fennel	0.1-1.0	90-110	0.1
Phorate	Cumin, Coriander, Fennel	0.1-1.0	88-102	0.1
Triazophos	Cardamom	0.1-1.0	92-99	0.1
	Pepper	0.1-1.0	88-107	0.1

*Description of agricultural practices for growing spice producing plants*

Cardamom, *Elettaria cardamomum* L. Maton, is mostly cultivated in the evergreen forests of Western Ghats of India. The crop is prone to infestation by diverse group of insect pests and diseases. Thrips and capsule borers are the major pests. On an average, farmers often apply pesticides every 15 to 18 days resulting in 18 to 25 sprays per year as against the recommended use of seven to eight treatments.

Pepper, *Piper nigrum* L is a native of South India. It is grown in the tropical regions. Pollu beetle, fungal Pollu and wilt disease are the limiting factors of pepper production in all the growing regions.

Cumin, coriander, and fennel are minor crops which are mainly cultivated in southern and western part of India. They are highly infested by aphid, thrips, cutworm, tobacco caterpillar and root knot nematodes. For the control of sucking pests like aphid and thrips, various pesticides are used as a foliar application. For the control of cutworm and tobacco caterpillar, profenofos is used, while phorate is used for the effective control of root knot nematode.

*Information regarding harvesting, processing and storage of the spices*

The cardamom is obtained by plucking the fruit or berry in the form of capsules from the spice crop. The sun dried or artificially dried capsules are then polished, graded and stored in polythene lined gunny bags or in wooden boxes in moisture free conditions.

Black pepper is produced from the still-green unripe drupes of the pepper plant. The drupes are boiled briefly in hot water, both to clean them and to prepare them for drying. The drupes are

dried in the sun or by machine for several days, during which the pepper around the seed shrinks and darkens into a thin, wrinkled black layer. The capsule of cardamom and unripe drupes for pepper are harvested up to 6 to 8 times a year.

Cumin and coriander are being harvested only once by separating the seeds from the dried spice-crop by using physical techniques. After removal of the physical impurities, the separated seeds are stored in gunny bags at room temperature. Aluminium phosphide is used for post-harvest protection.

The fennel seeds are obtained by drying matured inflorescence of the spice-crop under shade which are then stored in gunny bags at room temperature. The fennel is harvested up to 3 to 4 times a year.

## RESULTS OF MONITORING PESTICIDE RESIDUES

Monitoring data were submitted from the period of 2009-2014. Cumin, fennel and coriander samples (250-500 g) were collected from the retail outlets. No information was provided on sampling of cardamom and black pepper.

### *Black pepper (HS 0790)*

Of the 284 samples analysed none of them contained residues at or above the 0.1 mg/kg limit of quantification.

### *Cardamom (HS 0775)*

The residues detected are summarized in Table 2.

Table 2 Number of samples analysed and residues of various pesticides detected in cardamom

Compound	No.	Residues detected [mg/kg]
Acetamiprid	487	< 0.1
Carbofuran	487	< 0.1
Cypermethrin	487	0.10, 0.11 (3), 0.12, 0.13, 0.14 (4), 0.16, 0.18 (2), 0.19 (3), 0.20 (3), 0.21, 0.22 (2), 0.23 (3), 0.24 (2), 0.25, 0.26 (4), 0.27, 0.28 (2), 0.29 (2), 0.30 (2), 0.31 (2), 0.32 (6), 0.34 (5), 0.35(4), 0.36, 0.37 (3), 0.38, 0.39 (2), 0.41 (2), 0.43 (2), 0.44 (4), 0.45 (2), 0.46, 0.47, 0.49, 0.50 (2), 0.52, 0.53 (2), 0.54 (2), 0.55 (2), 0.56, 0.58 (2), 0.59 (2), 0.60, 0.63, 0.64, 0.65, 0.66, 0.69 (2), 0.70 (3), 0.71 (2), 0.73, 0.75 (2), 0.76, 0.77, 0.79, 0.81, 0.86, 0.87(2), 0.91, 0.92, 0.93, 0.99, 1.03, 1.12, 1.16, 1.34, 1.41, 1.54, 1.62, 1.65, 1.67, 1.76, 1.85, 1.94, 1.98, 2.00, 2.24, 2.97(2)
Lambda- cyhalothrin		0.10 (5), 0.11 (4), 0.12 (7), 0.13 (5), 0.14, 0.15 (4), 0.16 (3), 0.18 (3), 0.19 (7), 0.20 (6), 0.21 (5), 0.22, 0.23 (4), 0.24 (6), 0.25 (2), 0.26 (5), 0.27 (3), 0.28 (4), 0.29, 0.31 (2), 0.32 (3), 0.34 (5), 0.35 (3), 0.36 (2), 0.37 (3), 0.38, 0.40 (2), 0.41 (2), 0.42 (3), 0.43, 0.44, 0.45, 0.46, 0.49 (2), 0.50 (2), 0.51, 0.52 (3), 0.53, 0.54, 0.55, 0.57, 0.58 (2), 0.59, 0.61, 0.62 (2), 0.63, 0.67, 0.68, 0.69, 0.71, 0.73, 0.74 (2), 0.79, 0.82 (2), 0.86, 0.96, 0.99, 1.02, 1.04, 1.06, 1.20, 1.33, 1.87, 1.94, 3.06
Imidacloprid	487	0.10 (4), 0.11 (5), 0.12, 0.13 (2), 0.14 (2), 0.15 (2), 0.16, 0.17 (5), 0.18 (2), 0.20 (3), 0.21 (3), 0.22, 0.25, 0.27, 0.28, 0.30, 0.31, 0.32, 0.35, 0.38, 0.42, 0.47, 0.50, 0.51, 0.71, 0.80, 0.85
Profenofos	487	0.10 (3), 0.11 (5), 0.12 (3), 0.13 (2), 0.14 (5), 0.16, 0.17, 0.19 (2), 0.21, 0.22 (3), 0.24 (2), 0.25, 0.27, 0.28, 0.29, 0.30 (2), 0.3, 0.31, 0.32 (2), 0.34 (2), 0.36, 0.38, 0.39, 0.42 (2), 0.43, 0.44, 0.47 (2), 0.50 (2), 0.53 (2), 0.55, 0.63, 0.65, 0.66, 0.78, 0.79, 0.82, 0.91, 1.08, 1.19, 1.26, 1.54, 1.76, 1.9, 3.06
Triazophos	487	0.10, 0.11(2), 0.12(2), 0.14, 0.15, 0.16, 0.17 (4), 0.19(2), 0.21(5), 0.22, 0.23 (2), 0.25, 0.26, 0.28, 0.29 (3), 0.32, 0.33, 0.34, 0.37(2), 0.39(2), 0.40 (2), 0.43, 0.45 (3), 0.46, 0.47, 0.48, 0.49, 0.5 (2), 0.53 (2), 0.55 (2), 0.58, 0.59, 0.6, 0.61, 0.62, 0.63, 0.64, 0.69, 0.77, 0.82 (2), 0.84, 0.85 (2), 0.86, 1.06, 1.09, 1.11, 1.13, 1.34, 1.38, 1.42, 1.49, 1.67, 1.68, 1.71, 2.30, 3.64

### *Cumin (HS 0780)*

The residues detected are summarized in Table 3.

Table 3 Number of samples analysed and residues of various pesticides detected in cumin

Compound	No.	Residues detected
Acetamiprid	447	0.12(2), 0.13(2), 0.15, 0.16, 0.17, 0.18, 0.19, 0.20(2), 0.21, 0.23, 0.25, 0.27, 0.39, 0.40, 0.44, 0.46, 0.48, 0.58, 0.59, 0.65, 0.69, 0.76, 0.81, 1.35, 1.42, 1.43, 1.55, 2.04, 2.38, 2.93
Carbofuran	447	0.11(3), 0.12, 0.13, 0.15 (2), 0.21, 0.24, 0.27, 0.28, 1.35
Imidacloprid	447	0.14 (2), 0.25, 0.27, 0.36, 0.40, 0.45, 0.46
Phorate	447	0.11, 0.15 (2), 0.24, 0.26, 0.34, 0.76
Profenofos	447	0.10 (2), 0.11 (2), 0.12, 0.13 (4), 0.14 (2), 0.15 (2), 0.16 (2), 0.17, 0.18, 0.19(2), 0.20, 0.22 (2), 0.24 (2), 0.25, 0.27, 0.31 (2), 0.32, 0.34, 0.38, 0.39, 0.41, 0.42, 0.44, 0.47, 0.56, 0.63, 0.64, 0.65 (2), 0.66, 0.68 (2), 0.73, 0.77, 0.80, 0.82, 0.85, 0.86, 0.94, 0.95, 0.99, 1.03, 1.05, 1.07, 1.10, 1.21, 1.22 (2), 1.26(2), 1.30, 1.38, 1.51, 1.52, 1.61, 1.85, 1.98, 2.11, 2.32, 2.47, 2.69, 2.90, 3.83, 4.12

#### *Coriander (HS0779)*

Altogether 223 samples were analysed (positive results in brackets) for acetamiprid (0.02 mg/kg), imidacloprid (0), profenofos (0), phorate (0) and triazophos (0)

#### *Fennel (HS 0731)*

Altogether 255 samples were analysed (positive results in brackets) for acetamiprid (0.023, 0.03 mg/kg), carbofuran (0), imidacloprid (0.32), profenofos (0), phorate (0). and triazophos (0).

### APPRAISAL

The Thirty-sixth Session of CCPR decided (Alinorm 04/24A) to schedule by the JMPR the review of the monitoring data available for the elaboration of MRLs on spices for pesticides already in the Codex system.

Subsequently the 2004 JMPR developed the general principles for evaluation of monitoring data for recommending maximum residue levels, median and high residues depending on the number of residue data available for a given pesticide residue and commodity combination.

In accordance with the decision of the Forty-sixth Session of the CCPR, India submitted monitoring data from 2009-2014 for several pesticide residues in cardamom, black pepper, cumin, fennel and coriander for review by the 2015 JMPR.

#### *Sampling and analytical methods*

Cumin, fennel and coriander seed samples (250–500 g) were collected from the retail outlets. No information was provided on sampling of cardamom and black pepper.

The residues in/on cardamom and black pepper were extracted with a mixture of acetonitrile/water. The dried extract was purified with a primary secondary amine (PSA) adsorbent in the presence of MgSO<sub>4</sub>, and the residues were identified and quantified by GC-MS/MS or LC-MS/MS.

Seed spices were extracted with the mixture of acetonitrile/water and further determined with a modified QuEChERS multiresidue method using GC-MS/MS and/or LC-MS/MS.

For both methods, the recoveries were within the acceptable range, and reported LOQ was 0.1 mg/kg for all pesticide residue commodity combinations.

### ***Agricultural practices for growing spice producing plants***

Cumin, cardamom, coriander, pepper and fennel are minor crops which are mainly cultivated in the southern and western parts of India. The spices need to be protected against several pests and diseases which require repeated application of pesticides around the year.

The capsule of cardamom and unripe drupes for pepper are harvested up to 6 to 8 times a year. Cumin and coriander are harvested only once and fennel, up to 3 to 4 times.

No information was available on registered or approved uses or application conditions of the pesticides.

### ***Principles of evaluation of residues derived from monitoring programmes***

Principles for evaluation of monitoring data elaborated by the 2004 JMPR were followed:

- It is assumed that the laboratories reported only valid results. Therefore, all residue data are taken into account without excluding any value as an outlier.
- When residue values were reported as <LOQ, it does not necessarily mean that the sampled commodity was not treated with or exposed to the pesticide. While, it is unlikely that all the sampled commodities were treated with the pesticides looked for with the multi residue procedure, it cannot be assumed to be a 'nil' residue situation.
- When no sample contained detectable residues, the highest reported LOQ value is used as the maximum residue level. When justified based on the consumption, the high and median residue value are taken from the reported LOQ values.
- Distribution-free statistics are used in estimating the maximum residue level, covering the 95th percentile of the residue population at the 95% confidence level. Thus, the estimated maximum residue level encompasses at least 95% of the residues with 95% probability (in 95% of cases). To satisfy this requirement, a minimum of 58–59 samples is required. In such cases the uncertainty derived from the limited number of data points are taken into account in recommending maximum residue levels.
- When > 120 samples contain detected residues, the sample size is sufficiently large to calculate the upper 95% one-tailed confidence limit of the 95<sup>th</sup> percentile of the population of residues, which should be used for estimation of maximum residue level after rounding up to the next value of the scale of expressing residues according to the OECD MRL calculator.
- Monitoring results are not used for estimating maximum residue levels that reflect post-harvest use.

Furthermore, the Meeting decided that:

Maximum residue levels would only be estimated for those pesticide residues which were determined according to the definition of residues for enforcement purposes. Consequently, the reported residues of carbofuran and imidacloprid were not considered.

### ***Residues resulting from monitoring programmes***

#### ***Black pepper***

Of the 284 samples analysed for acetamiprid, cypermethrin, lambda-cyhalothrin, profenofos, and triazophos, none were found to contain residues at or above the LOQ of 0.1 mg/kg.

The Meeting concluded that the reported LOQ values are higher than those which can be obtained with current analytical methods. Consequently, the Meeting agreed there was no reason to revise its previous recommendations for maximum residue levels for cypermethrin, lambda cyhalothrin, profenofos and triazophos.

The Meeting estimated a maximum residue level and median residue of 0.1 mg/kg for acetamiprid.

#### *Cardamom seed*

Results of analyses of 487 samples were reported for acetamiprid, cypermethrin, lambda-cyhalothrin, imidacloprid, profenofos and triazophos.

No residues (< 0.1 mg/kg) of acetamiprid were detected.

Based on the results, the Meeting estimated a maximum residue and median residue of 0.1 mg/kg for acetamiprid.

Out of 487 samples 133 contained cypermethrin residues which were in rank order: 0.10, 0.11 (3), 0.12, 0.13, 0.14 (4), 0.16, 0.18 (2), 0.19 (3), 0.20 (3), 0.21, 0.22 (2), 0.23 (3), 0.24 (2), 0.25, 0.26 (4), 0.27, 0.28 (2), 0.29 (2), 0.30 (2), 0.31 (2), 0.32 (6), 0.34 (5), 0.35(4), 0.36, 0.37 (3), 0.38, 0.39 (2), 0.41 (2), 0.43 (2), 0.44 (4), 0.45 (2), 0.46, 0.47, 0.49, 0.50 (2), 0.52, 0.53 (2), 0.54 (2), 0.55 (2), 0.56, 0.58 (2), 0.59 (2), 0.60, 0.63, 0.64, 0.65, 0.66, 0.69 (2), 0.70 (3), 0.71 (2), 0.73, 0.75 (2), 0.76, 0.77, 0.79, 0.81, 0.86, 0.87(2), 0.91, 0.92, 0.93, 0.99, 1.03, 1.12, 1.16, 1.34, 1.41, 1.54, 1.62, 1.65, 1.67, 1.76, 1.85, 1.94, 1.98, 2.00, 2.24, and 2.97(2) mg/kg.

The upper 95% confidence limit of the detected residues is 2.24 mg/kg.

The Meeting estimated a maximum residue level of 3 mg/kg and a median residue of 0.43 mg/kg for cypermethrin which replaces its previous recommendations.

Out of 487 samples 146 contained lambda cyhalothrin residues which were in rank order: 0.10 (5), 0.11 (4), 0.12 (7), 0.13 (5), 0.14, 0.15 (4), 0.16 (3), 0.18 (3), 0.19 (7), 0.20 (6), 0.21 (5), 0.22, 0.23 (4), 0.24 (6), 0.25 (2), 0.26 (5), 0.27 (3), 0.28 (4), 0.29, 0.31 (2), 0.32 (3), 0.34 (5), 0.35 (3), 0.36 (2), 0.37 (3), 0.38, 0.40 (2), 0.41 (2), 0.42 (3), 0.43, 0.44, 0.45, 0.46, 0.49 (2), 0.50 (2), 0.51, 0.52 (3), 0.53, 0.54, 0.55, 0.57, 0.58 (2), 0.59, 0.61, 0.62 (2), 0.63, 0.67, 0.68, 0.69, 0.71, 0.73, 0.74 (2), 0.79, 0.82 (2), 0.86, 0.96, 0.99, 1.02, 1.04, 1.06, 1.20, 1.33, 1.87, 1.94, and 3.06 mg/kg.

The upper 95% confidence limit of the residues is 1.87 mg/kg.

The Meeting estimated a maximum residue level of 2 mg/kg and a median residue of 0.28 mg/kg for cyhalothrin, which replaces its previous recommendations.

Out of 487 samples 68 contained profenofos residues which were in rank order: 0.10 (3), 0.11 (5), 0.12 (3), 0.13 (2), 0.14 (5), 0.16, 0.17, 0.19 (2), 0.21, 0.22 (3), 0.24 (2), 0.25, 0.27, 0.28, 0.29, 0.30 (3), 0.31, 0.32 (2), 0.34 (2), 0.36, 0.38, 0.39, 0.42 (2), 0.43, 0.44, 0.47 (2), 0.50 (2), 0.53 (2), 0.55, 0.63, 0.65, 0.66, 0.78, 0.79, 0.82, 0.91, 1.08, 1.19, 1.26, 1.54, 1.76, 1.9, and 3.06 mg/kg.

The 95<sup>th</sup> percentile of the residues is 1.4 mg/kg. The database is insufficient for calculation of the upper confidence limit.

Taking into account the limited database, the Meeting estimated a maximum residue level of 3 mg/kg and a median residue of 0.3 mg/kg for profenofos which replaces its previous recommendations.

Out of 487 samples 79 contained triazophos residues which were in rank order: 0.10, 0.11(2), 0.12(2), 0.14, 0.15, 0.16, 0.17 (4), 0.19 (2), 0.21(5), 0.22, 0.23 (2), 0.25, 0.26, 0.28, 0.29 (3), 0.32, 0.33, 0.34, 0.37(2), 0.39(2), 0.40 (2), 0.43, 0.45 (3), 0.46, 0.47, 0.48, 0.49, 0.5 (2), 0.53 (2), 0.55 (2), 0.58, 0.59, 0.6, 0.61, 0.62, 0.63, 0.64, 0.69, 0.77, 0.82 (2), 0.84, 0.85 (2), 0.86, 1.06, 1.09, 1.11, 1.13, 1.34, 1.38, 1.42, 1.49, 1.67, 1.68, 1.71, 2.30, and 3.64 mg/kg.

The 95<sup>th</sup> percentile of the residues is 1.7 mg/kg. The database is insufficient for calculation of the upper confidence limit.

Taking into account the limited database, the Meeting estimated a maximum residue level of 4 mg/kg and a median residue of 0.45 mg/kg for triazophos, which replaces the previous recommendations.

*Coriander seed*

Altogether 223 samples were analysed (positive results in brackets) for acetamiprid (0.02 mg/kg), profenofos (0), phorate (0) and triazophos (0). The reported LOQ was 0.1 mg/kg.

The residue data was not sufficient to estimate a maximum residue level for acetamiprid.

The Meeting estimated maximum and median residue levels of 0.1 mg/kg for profenofos, phorate and triazophos in coriander seed.

*Cumin seed*

The results of analyses of 447 samples were reported for acetamiprid, phorate and profenofos.

Out of 447 samples acetamiprid (33) and phorate (7) residues were detected above the LOQ of 0.1 mg/kg.

As the number of detected residues is lower than the minimum required (58), no recommendations could be made for maximum residue levels for acetamiprid and phorate.

Out of 447 samples 76 contained profenofos residues which were in rank order: 0.10 (2), 0.11 (2), 0.12, 0.13 (4), 0.14 (2), 0.15 (2), 0.16 (2), 0.17, 0.18, 0.19(2), 0.20, 0.22 (2), 0.24 (2), 0.25, 0.27, 0.31 (2), 0.32, 0.34, 0.38, 0.39, 0.41, 0.42, 0.44, 0.47, 0.56, 0.63, 0.64, 0.65 (2), 0.66, 0.68 (2), 0.73, 0.77, 0.80, 0.82, 0.85, 0.86, 0.94, 0.95, 0.99, 1.03, 1.05, 1.07, 1.10, 1.21, 1.22 (2), 1.26(2), 1.30, 1.38, 1.51, 1.52, 1.61, 1.85, 1.98, 2.11, 2.32, 2.47, 2.69, 2.90, 3.83, and 4.12 mg/kg.

The 95th percentile of the residues is 2.52 mg/kg. The database is insufficient for calculation of the upper confidence limit. Taking into account the limited database, the Meeting estimated a maximum residue level of 5 mg/kg and median residue of 0.635 mg/kg for profenofos.

*Fennel, seed*

Altogether 255 samples were analysed (positive results in brackets) for acetamiprid (0.023, 0.03 mg/kg), profenofos (0), phorate (0) and triazophos (0).

The Meeting estimated maximum and median residue levels 0.1 mg/kg for profenofos, phorate and triazophos.

## Maximum residue level recommendations for Spices

Pesticide	CCN	Commodity	MRL mg/kg		Median mg/kg
			New	Previous	
Acetamiprid (246)	HS 0790	Pepper, Black; White	0.1		0.1
	HS 0775	Cardamom	0.1		0.1
Cypermethrin (118)	HS 0775	Cardamom	3		0.43
Lambda-cyhalothrin (146)	HS 0775	Cardamom	2	0.03	0.28
	HS 0191	Spices, Fruits and Berries (except Cardamom)	0.03		
Phorate (112)	HS 0779	Coriander, seed	0.1	0.5	0.1
	HS 0731	Fennel, seed	0.1	0.5	0.1
	HS 0190	Spices, Seeds (except Coriander seed and Fennel seed)	0.5		
Profenofos (171)	HS 0775	Cardamom	3	0.07	0.3
	HS 0779	Coriander, seed	0.1		0.1
	HS 0780	Cumin seed	5		0.635
	HS 0731	Fennel, seed	0.1		0.1
	HS 0191	Spices, Fruits and Berries (except Cardamom)	0.07		
Triazophos (143)	HS 0775	Cardamom	4	0.07	0.45
	HS 0779	Coriander, seed	0.1		0.1
	HS 0731	Fennel, seed	0.1		0.1
	HS 0191	Spices, Fruits and Berries (except Cardamom)	0.07		

## DIETARY RISK ASSESSMENT

*Long-term intake*

The contribution of residues present in the pepper, black white to the long-term-intake of acetamiprid and lambda-cyhalothrin was addressed in the evaluation of these compounds. No consumption data is available for cardamom, coriander, cumin and fennel seeds in the 17 GEMS/Food Cluster diets to estimate the contribution of the residues present in these spices to the long-term-intake of acetamiprid, cypermethrin, lambda-cyhalothrin, profenofos, phorate and triazophos.

*Short-term intake*

The International Estimated Short-Term Intake (IESTI) of acetamiprid and lambda-cyhalothrin from the consumption of pepper, black white and cardamom seed was addressed in the evaluation of these compounds.

The IESTIs for profenofos, phorate and triazophos from the consumption of the spices considered by the current Meeting were estimated. The results are shown in Annex 4 to the 2015 Report. The IESTI represented 0% of the ARfD of cypermethrin and profenofos, a maximum of 10% of the ARfD of phorate and a maximum of 7% of the ARfD of triazophos. The Meeting concluded that the short-term intake of cypermethrin, profenofos, phorate and triazophos residues from the uses considered by the current Meeting was unlikely to present a public health concern.