Cold treatments for fruit flies (draft annexes to ISPM No. 28)

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Outline

- Background
- General considerations
- Issues associated with drafting the cold treatments
- Points applying to all the draft treatments
- A summary of each treatment
- References

Background

- Treatment submissions were evaluated by the Technical Panel on Phytosanitary Treatments (TPPT) in accordance with ISPM No. 28: *Phytosanitary treatments for regulated pests*.
- 8 cold treatments were recommended by the TPPT and approved by the Standards Committee for member consultation (special process).
- A summary report was produced, which explains general principles, detailed considerations for each treatment and issues associated with drafting the treatments.

General considerations

- The TPPT recommended that the following principles should be applied when evaluating temperature-based treatments:
  - Mortality assessments - living larvae should be considered as survivors
  - Insect genotype - lab-based colonies may become susceptible over time
  - Pre-treatment acclimation - conditions insects are exposed to immediately prior to treatment may affect susceptibility to temperature treatments
  - Commodity variability - hosts should be sampled from as wide a geographic area as possible
  - Scale of treatment application - scale up effects should be considered
  - Rate of temperature change - may affect effectiveness

Issues associated with drafting the cold treatments

- Each treatment is for an individual fruit fly species
- Treatments are for separate *Citrus* species - different *Citrus* species respond differently to cold treatments.
- Cultivars of *C. sinensis* (orange) are quoted separately, unless all cultivars responded similarly – research has shown that cultivars of *C. sinensis* respond differently to cold treatments.
- For other *Citrus* species cultivars are not differentiated. Where data were submitted for different cultivars, the lowest efficacy level is quoted.
- The minimum level of efficacy for an international cold treatment for fruit flies was recommended to be $ED_{99.99}$.

Drafting issues (continued)

- The TPPT considered combining data from certain experiments done at 2° and 3°C, but decided against this. A higher overall efficacy level would have resulted for the 2°C treatments.
- Different schedules (with efficacy levels) were included for treatments where data existed.
- Problems with nomenclature of *Citrus reticulata* and hybrids were resolved by using Cottin, R. 2002. *Citrus of the world: a citrus directory*. France, INRA-CIRAD.
- Temperature sensitivities were not added to schedules - experimental probes are often more sensitive than commercial probes.

The following apply to all of the draft treatments:

- The intended outcome is larval mortality at the stated efficacy.
- Efficacy is quoted as ED at the 95% confidence level.
- It is a requirement that the commodity must reach the treatment temperature before treatment commences. The commodity temperature should be monitored and should not exceed the stated level.
- In “Other relevant information” it is noted that pre-cooling is required.

2009-Draft-Cold Treatment-01: Cold treatment of *Citrus sinensis* for *Ceratitis capitata*

Schedules		Efficacy level	Cultivar	Reference
1.	2°C for 18 days	$ED_{99.9982}$	Navel	De Lima *et al*., 2007
		$ED_{99.9979}$	Valencia	
2.	3°C for 20 days	$ED_{99.9980}$	Navel	De Lima *et al*., 2007
		$ED_{99.9979}$	Valencia	
3.	2°C for 21 days	$ED_{99.9917}$	Washington Navel, Salustiana, Valencia and Lue Gim Gong	Anon., 2007a

2009-Draft-Cold Treatment-02: Cold treatment of *Citrus reticulata* ×*Citrus sinensis* for *Ceratitis capitata*

Schedules		Efficacy level	Reference
1.	2°C for 18 days	$ED_{99.9972}$	De Lima *et al.*, 2007
2.	3°C for 20 days	$ED_{99.9972}$	De Lima *et al.*, 2007

Other relevant information:

- These schedules were developed using cultivars Ellendale and Murcott

2009-Draft-Cold Treatment-03: Cold treatment of *Citrus sinensis* for *Bactrocera tryoni*

Schedules		Efficacy level	Cultivar	Reference
1.	2°C for 16 days	$ED_{99.9973}$	Navel	De Lima *et al.*, 2007
		$ED_{99.9960}$	Valencia	
2.	3°C for 16 days	$ED_{99.9988}$	Navel	De Lima *et al.*, 2007
		$ED_{99.9976}$	Valencia	

2009-Draft-Cold Treatment-04: Cold treatment of *Citrus reticulata* × *Citrus sinensis* for *Bactrocera tryoni*

Schedules		Efficacy level	Reference
1.	2°C for 16 days	$ED_{99.9968}$	De Lima *et al.*, 2007
2.	3°C for 16 days	$ED_{99.9989}$	De Lima *et al.*, 2007

Other relevant information:

- These schedules were developed using cultivars Ellendale and Murcott

2009-Draft-Cold Treatment-05: Cold treatment of *Citrus limon* for *Bactrocera tryoni*

Schedules		Efficacy level	Reference
1.	2°C for 14 days	$ED_{99.9935}$	De Lima *et al*., 2007
2.	3°C for 14 days	$ED_{99.9928}$	De Lima *et al*., 2007

Other relevant information:

- These schedules were developed using cultivar Lisbon

2009-Draft-Cold Treatment-06: Cold treatment of *Citrus paradisi* for *Ceratitis capitata*

Schedules		Efficacy level	Reference
1.	2°C for 19 days	$ED_{99.9917}$	Anon., 2007b
2.	3°C for 23 days	$ED_{99.9916}$	Anon., 2007c

Other relevant information:

- Schedule 1 was developed using cultivars Marsh Seedless, Star Ruby, Henninger's Ruby and Rouge la Toma.
- Schedule 2 was developed using cultivar Henninger's Ruby

2009-Draft-Cold Treatment-07: Cold treatment of *Citrus reticulata* cultivars and hybrids for *Ceratitis capitata*

Schedule		Efficacy level	Reference
1.	2°C for 23 days	$ED_{99.9918}$	Anon., 2007d

Other relevant information:

- The schedule was developed using the following cultivars and hybrids: Clementinas Group (*Citrus reticulata*), Ellendale (*Citrus reticulata* × *C. sinensis)*, Nova (*C. reticulata* × tangelo cultivar Orlando (*C. reticulata* × *Citrus paradisi)*) and Murcott (*Citrus reticulata* × *Citrus sinensis*).

2009-Draft-Cold Treatment-08: Cold treatment of *Citrus limon* for *Ceratitis capitata*

Schedules		Efficacy level	Reference
1.	2°C for 16 days	$ED_{99.9977}$	De Lima *et al.*, 2007
2.	3°C for 18 days	$ED_{99.9975}$	De Lima *et al.*, 2007

Other relevant information:

- *Citrus limon* is considered a conditional host for *Ceratitis capitata*
- This treatment was only validated, and therefore is only recognised, as a treatment for *Ceratitis capitata* infesting *Citrus limon* and is not applicable to *C. latifolia* and *C. aurantiifolia*
- These schedules were developed using cultivar Lisbon

References

- Anon. 2007a. Annex: Quarantine cold treatment of oranges for medfly (*Ceratitis capitata* Wied.). Document number 2007-TPPT-109a. Submission by Argentina in response to the 2007 IPPC call for treatments.
- Anon. 2007b. Annex: Quarantine cold treatment of grapefruits for medfly (*Ceratitis capitata* Wied.). Document number 2007-TPPT-110a. Submission by Argentina in response to the 2007 IPPC call for treatments.
- Anon. 2007c. Annex: Quarantine cold treatment for grapefruits for medfly (*Ceratitis capitata* Wied.). Document number 2007-TPPT-111a. Submission by Argentina in response to the 2007 IPPC call for treatments.
- Anon. 2007d. Annex: Quarantine cold treatment of tangerines and hybrids for medfly (*Ceratitis capitata* Wied.). Document number 2007-TPPT-112a. Submission by Argentina in response to the 2007 IPPC call for treatments.
- De Lima, C.P.F., Jessup, A.J., Cruickshank, L., Walsh, C.J. & Mansfield, E.R. 2007. Cold disinfestation of citrus (*Citrus* spp.) for Mediterranean fruit fly (*Ceratitis capitata*) and Queensland fruit fly (*Bactrocera tryoni*) (Diptera:Tephritidae). *New Zealand Journal of Crop and Horticultural Science*, 35: 39–50.