

A Methyl Bromide Quarantine Treatment to Control *Eotetranychus kankitus*, Citrus Red Mite and Arrowhead Scale on Satsuma Mandarins for Export to The United States

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Abstract : *Eotetranychus kankitus* EHARA (EK) adults (n=8,904) and eggs (n=1,125) on kidney bean leaves did not survive by methyl bromide fumigation (MB) at 38 g/m³ or below for 2 hours at 15°C. Citrus red mite (CM), *Panonychus citri* (McGREGOR) adults (n=9,285) and eggs (n=16,084) on satsuma mandarin leaves, arrowhead scale (AS), *Unaspis yanonensis* (KUWANA) adults (n=6,394) on satsuma mandarin fruit did not survive at 48g/m³ for 2 hours at 15°C, respectively. Three species were killed completely by the disinfestation standard (48g/m³ of MB for 2 hours at 15°C) developed for export of satsuma mandarins to the U.S.

Key words : Insecta, *Eotetranychus kankitus*, *Panonychus citri*, *Unaspis yanonensis*, methyl bromide, quarantine treatment

Introduction

Mealybugs were found on satsuma mandarins from Japan several times by the quarantine inspection in the United States. The fruit with mealybugs were rejected the importation or transported to other countries (YOSHIZAWA, 1990). Therefore, MISUMI et al. (1994) developed a methyl bromide (MB) quarantine treatment (48 g/m³ for 2 hours at 15°C or above with 32 % loading) against Japanese mealybug, *Planococcus kraunhiae* (KUWANA) and citrus mealybug, *Pseudococcus citriculus* GREEN on export satsuma mandarins to the United States.

In Japan, there are some other species, such as *Eotetranychus kankitus* EHARA (EK), citrus red mite (CM), *Panonychus citri* (McGREGOR), and arrowhead scale (AS), *Unaspis yanonensis* (KUWANA), on satsuma mandarin (KORENAGA, 1992), which do not occur in the United States.

Our objective was to confirm if these insects could be killed completely by the disinfestation standard established for the mealybugs .

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Materials and Methods

1. Test Insects

The EK were obtained from a laboratory colony maintained on kidney bean leaves in the Fruit Tree Research Station, Akitsu Branch, MAFF. The infested kidney bean leaves with water moistened paper towels were sent to the Research Division, Yokohama Plant Protection Station (YPPS) in September and October in 1991. The CM were collected from satsuma mandarin orchards in the Shizuoka Prefectural Citrus Experiment Station in November 1991. The citrus leaves infested with the adults were sent to the YPPS. The AS were collected from satsuma mandarin orchards in the Shizuoka Prefectural Citrus Experiment Station in November 1992. The fruit infested with the adults were sent to the YPPS. All test insects were stored at 15°C for 24 hours before fumigation.

2. Methyl Bromide Fumigation

Fumigations for the EK and the CM were conducted in 29.5-liter fiberglass chambers described by MISUMI et al. (1994). The leaves infested with the EK were placed on the agar culture medium in petri dishes and a total of 36 and 23 dishes were then fumigated with 35 or 38 g/m³ of MB for 2 hours at 15°C. A total of 465.2 g infested leaves with the CM were fumigated with 48 g/m³ of MB for 2 hours at 15°C. A total of 47 and 82 fruit infested with the AS were fumigated with 48 g/m³ of MB for 2 hours at 15°C in 0.52 m³ stainless steel chamber described by MISUMI et al. (1994).

During fumigation, the built-in air circulation fan was kept on and MB gas concentrations were monitored by gas chromatograph (FID; GC 8AF, Shimadzu) at time intervals of 15 - 20 min. after injection of MB. Following fumigation, the air-fumigant mixture was exhausted for one hour using the built-in ventilation apparatus.

3. Evaluation of Mortality

After fumigation, all insects were held at 25°C, 70% RH for 24 hours dark. The mite adults were assessed under the microscope. The mortality of the scale were determined to move or not when stimulating by a needle. The mortality of eggs were determined by counting the number of eggs hatched every 2 - 3 days for 1 - 2 weeks. The number of insects in fumigated lot was determined based on that of the untreated control lot.

Results and Discussion

Gas concentrations during fumigation are shown in Table 1. The average of residual gas concentration after 2 hours of exposure were 29.6 (29.4 - 29.8 mg/ℓ), 34.8 (34.6 - 35.0 mg/ℓ), 41.1 and 44.3 mg/ℓ (43.0 - 45.6 mg/ℓ), respectively, for the initial dose of 38, 35, 48 and 48 g/m³.

Result of mortality tests for the EK, the CM and the AS treated by MB fumigation (48g/m³ or below for 2 hours at 15°C) are shown in Table 2. A total of 8,904 adults and 1,125 eggs of the EK were killed completely at 38 g/m³ or below, and a total of 9,285 adults and 16,084 eggs of the CM and 6,394 of the AS adult were also killed completely at 48 g/m³, respectively.

These mortality tests showed that the EK, the CM and the AS which may be found on satsuma mandarin fruit at harvest were killed completely by the disinfestation standard (48 g/m³

Table 1. Methyl bromide concentration recorded in 29.5-liter fiberglass chamber or 0.52 m³ stainless steel chamber. Fumigation at doses of 35, 38 or 48 g/m³ for 2 hours at 15°C.

Pest	Dose g/m ³	MB Concentration (mg/l)			
		15	20	30	120 min.
<i>Eotetranychus kankitsu</i> ¹⁾	38 ³⁾		38.1		29.8
	38 ³⁾		37.6		29.7
	38 ³⁾		38.4		29.5
	38 ³⁾		38.3		29.4
	35		35.0		34.6
	35		35.0		34.7
	35		35.0		35.0
citrus red mite ¹⁾	48	43.8		42.1	41.1
arrowhead scale ²⁾	48	47.4			43.0
	48	51.0			45.6

1) A 29.5-liter fiberglass chamber was used.

2) A 0.52 m³ stainless steel chamber was used.

3) Test insects were fumigated with filler fruit (32% loading).

Table 2. Mortalities of *Eotetranychus kankitus*, citrus red mit, *Panonychus citri*, and arrowhead scale, *Unaspis yanonensis*, fumigated with methyl bromide at doses of 35, 38 or 48 g/m³ for 2 hours at 15°C.

Pest	Dose (g/m ³)	Stage	Control	Fumigation	
			No. survived	No. treated	No. survived*
<i>Eotetranychus kankitus</i>	38	adult	1,735	6,940	0
	35	adult	591	1,964	0
		egg	202	1,125	0
citrus red mite	48	adult	2,327	9,285	0
		egg	4,031	16,084	0
arrowhead scale	48	adult	217	2,040	0
		adult	425	4,354	0

* Based on survival in untreated control.

of MB for 2 hours at 15°C). The MB fumigation standard would be sufficiently guarantee the quarantine security.

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和 文 摘 要

ミヤケハダニ *Eotetranychus kankitsu* EHARA,
ミカンハダニ *Panonychus citri* (McGREGOR) 及び
ヤノネカイガラムシ *Unaspis yanonensis* (KUWANA) の
臭化メチルくん蒸による検疫処理

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インゲン葉に寄生したミヤケハダニ *Eotetranychus kankitsu* EHARA の成虫 (8,904) と卵 (1,125) が臭化メチル 38 g/m³ またはそれ以下の薬量, 2 h, 15°C, で完全殺虫された。ウンシュウミカン葉に寄生するミカンハダニ *Panonychus citri* (McGREGOR) の成虫 (9,285) と卵 (16,084), ウンシュウミカンの果実に寄生する

ヤノネカイガラムシ *Unaspis yanonensis* (KUWANA) の成虫 (6,394) が臭化メチル 48 g/m³, 2 h, 15°C, でそれぞれ完全殺虫された。これらのことから, 3種害虫がウンシュウミカンの対米輸出くん蒸処理基準 (臭化メチル 48 g/m³, 2 h, 15°C) で完全に殺虫されることが確認された。

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