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Short Communication

Methyl Bromide Quarantine Treatment for Persimmon Fruit Moth in Japanese Persimmons

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Abstract: Complete mortality of larvae of persimmon fruit moth, *Stathmopoda masinissa* MEYRICK was confirmed by methyl bromide fumigation schedule with 48g/m^3 for 2 hours at 15℃ with 50% loading. The results showed that a total of 31,739 larvae in fresh persimmons obtained from pesticide unsprayed orchards were killed completely in 16 replicated tests conducted in 1992–1999. The methyl bromide standard would provide for sufficient quarantine security for exporting Japanese persimmons.
Key words: Insecta, *Stathmopoda masinissa*, quarantine treatment, methyl bromide, Japanese persimmons

Introduction

Fresh Japanese persimmon, *Diospyros kaki* THUNB. has not been exported from Japan to the United States because of quarantine restrictions against persimmon fruit moth, *Stathmopoda masinissa* MEYRICK and yellow peach moth, *Conogethes punctiferalis* (GUENÉE) and disinfestation treatments must be developed against two species of the pest to meet both countries' quarantine regulations (YOSHIZAWA, 1990). A methyl bromide fumigation standard(48g/m^3 for 2 hours at 15℃ with 50% loading) without chemical injury of fresh persimmons (KAWAKAMI *et al.*, 1991 ; NAKAMURA *et al.*, 1995) and with complete mortality of the target pest (TOMOMATSU *et al.*, 1995) was established in 1992 for controlling of larval stage of the persimmon fruit moth which may be present in fruit at harvest. Complete mortality was also confirmed with a total of 13,163 larvae in the large-scale test conducted in 1992-1994 (TOMOMATSU *et al.*, 1995). The number of the test insect, however, was not enough as a criterion for assessing the completeness of a treatment schedule. This is because that modified form of 'Probit 9' is employed in Japan, i. e. '0' survival out of 30,000 treated individuals of the most resistant stage of the test insect.

Large-scale mortality tests were conducted to confirm if complete mortality of the persimmon fruit moth larvae could be obtained from the established methyl bromide standard.

Table 1. Methyl bromide gas concentrations and fruit temperatures recorded in a $1m^3$ fumigation chamber. Fumigation at a dose of 48.0 g/m^3 for 2 hours at 15℃ with 49.1-51.9% loading.

Year	Replicate	No. fruit tested	loading (v/v : %)	Gas concentration (mg/l)				Fruit Temp (℃)
				10	30	60	120min	
1992	1	2,847	50.5	58.3	56.2	52.8	45.6	15
1993	1	2,997	50.4	55.7	53.0	49.1	46.1	15
	2	3,045	50.3	59.8	53.1	50.7	46.5	15
1994	1	3,387	50.2	53.1	49.1	46.3	41.6	15
	2	3,577	51.9	55.9	50.2	47.9	46.5	15
	3	2,687	49.1	51.8	47.9	46.3	40.7	15
1995	1	2,590	50.1	57.5	54.0	51.6	46.8	15
	2	2,543	50.2	58.1	54.4	52.3	48.6	15
	3	2,800	50.3	59.7	56.3	54.0	48.6	15
1996	1	2,809	50.2	49.4	47.1	44.4	40.7	15
	2	3,039	50.0	56.7	54.7	50.8	47.5	15
1997	1	2,793	50.6	56.1	53.1	50.4	44.8	15
	2	2,661	50.6	57.7	54.6	50.6	46.5	15
1998	1	2,514	50.6	59.1	56.2	52.9	46.5	15
	2	2,896	50.6	57.9	56.0	52.3	48.1	15
1999	1	2,819	50.6	48.1	46.7	42.6	39.7	15

Materials and Methods

1. Test Fruit and insects

Fresh persimmon fruit infested with 3rd instar larvae of the persimmon fruit moth were collected from orchards in Gifu, Nara and Wakayama Prefectures, because mass-rearing techniques for the insect have not been established in both artificial diets and fresh persimmon fruit (ODA, 1982; CLEARWATER, 1984). These test fruit put in netted bags were placed in a plastic bin ($0.046m^3$) and then stored overnight (18 hours) at fumigation temperature of 15℃ at the fumigation room of Kobe Plant Protection Station in Kobe-City.

2. Fumigation

Four bins containing fruit were placed in a $1m^3$ stainless steel fumigation chamber equipped with a $7.5m^3$/minute circulation and $1.1m^3$/minute ventilation apparatus. MB enclosed in ampoules or cans was applied by using a built-in ampoule breaker or can opener. Fumigation was conducted at a dose of $48g/m^3$ for 2 hours at 15℃ with 49.1 - 51.9% loading.

The built-in circulation apparatus was kept on throughout fumigation. Gas concentrations were monitored by the interference refractometer (Riken-18 and 21, Riken) at time intervals of 10, 30, 60 and 120 minutes after the commencement of fumigation. Fumigation was followed by an hour of exhausting using the ventilation apparatus.

Table 2. Mortality of mature larvae of the persimmon fruit moth, Stathmopoda masinissa in Japanese persimmons by methyl bromide fumigation at a dose of 48g/m^3 for 2 hours at 15℃ with 49.1-51.9% loading.

Year	Replicate	Treatment	No. fruit infested	No. Larvae tested*	No. Larvae survived	Percent mortality
1992	1	Fumigated	2,847	2,377	0	100.0
		Cont.	150	142	138	2.8
1993	1	Fumigated	2,997	1,551	0	100.0
		Cont.	172	161	155	3.7
	2	Fumigated	3,045	1,041	0	100.0
		Cont.	182	108	107	0.9
1994	1	Fumigated	3,387	2,637	0	100.0
		Cont.	375	302	292	3.1
	2	Fumigated	3,577	3,003	0	100.0
		Cont.	411	348	345	0.9
	3	Fumigated	2,687	2,554	0	100.0
		Cont.	301	293	286	2.4
1995	1	Fumigated	2,377	1,983	0	100
		Cont.	302	253	252	0.4
	2	Fumigated	2,202	2,132	0	100
		Cont.	254	251	245	2.4
	3	Fumigated	2,800	2,157	0	100
		Cont.	327	254	252	0.8
1996	1	Fumigated	2,809	2,119	0	100
		Cont.	328	263	249	5.3
	2	Fumigated	1,249	1,018	0	100
		Cont.	141	117	115	1.7
1997	1	Fumigated	1,913	1,623	0	100
		Cont.	225	196	191	2.6
	2	Fumigated	2,661	1,803	0	100
		Cont.	299	212	203	4.2
1998	1	Fumigated	2,514	1,760	0	100
		Cont.	287	205	200	2.9
	2	Fumigated	2,896	1,942	0	100
		Cont.	319	219	214	2.3
1999	1	Fumigated	2,819	2,039	0	100
		Cont.	315	230	228	0.9
Total	16	Fumigated	42,780	31,739	0	100
		Cont.	4,388	3,554	3,472	2.3

* The number of test insects in fumigated lots was estimated on the base of survival in untreated control lots.

3. Confirmation of Mortality

Fumigated and untreated control fruit were stored at room temperatures of 20-23℃ and cut and assessed after 4 days. Moribund larvae were put on a sliced persimmon and assessed after further 3 days.

Results and Discussion

1. Gas Concentrations and Temperatures during Fumigation

Table 1 shows methyl bromide gas concentrations and temperatures during fumigation in replicated tests. Residual gas concentrations in 2 hours after fumigation were 39.7 - 48.6mg/l and fruit temperatures were 15.0℃, respectively.

2. Mortality

Table 2 shows results of the mortality test with 16 replicates conducted in 1992 to1999. A total of 31,739 larvae (the number of test insect in fumigated lots was estimated on the base of survival in untreated control lots) of the persimmon fruit moth were killed completely at a dose of 48g/m^3 for 2 hours at 15℃ with 49.1-51.9% loading. The fumigation schedule established in 1992 based on the basic tests with the susceptibility of the insect to methyl bromide fumigation, gas absorption ratios to fumigation items (TOMOMATSU *et al.*, 1995) and quality of persimmon fruit fumigated with methyl bromide (KAWAKAMI *et al.*, 1991; NAKAMURA *et al.*, 1995) would provide a complete mortality of all stages of the peach fruit moth and the yellow peach moth on/in Japanese persimmon fruit.

From large-scale confirmatory tests, the established methyl bromide standard (a dose of 48g/m^3 for 2 hours at 15℃ with 50% loading) would provide for sufficient quarantine security for exporting the Japanese persimmons to the USA.

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和 文 摘 要

柿果実に寄生するカキノヘタムシガの臭化メチルくん蒸による検疫処理

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カキノヘタムシガ，*Stathmopoda masinissa* MEYRICK が臭化メチル消毒基準（48g/m³，2時間，15℃，収容率50%）で完全殺虫されるか確認した。1992年から1999年にかけて実施した16反復にわたる試験において，殺虫剤無散布のほ場から得られた生果実中の合計31,739頭の幼虫は完全に殺虫された。この臭化メチル消毒基準は，輸出用のカキに対して検疫の安全性を十分に提供するものである。