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Susceptibility of Kanzawa Spider Mite, *Tetranychus kanzawai* KISHIDA, enter to Mixture Gas Fumigation with Methyl Bromide and Phosphine

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Abstract: The Kanzawa spider mite, *Tetranychus kanzawai* KISHIDA (egg, larva, protonymph, deutonymph and adult), were fumigated by mixture gas with methyl bromide (10 g/m^3) and phosphine (3 g/m^3) at 15°C to study their susceptibility. The $LT_{50's}$ and $LT_{90's}$ for egg stage were 105.1 and 185.6 minutes, respectively. A 100% mortality for egg stage was attained by the fumigation at 15°C for 240 minutes, and egg was the most tolerant stage.
Key words: Arachnida, *Tetranychus kanzawai*, mixture gas fumigation, methyl bromide, phosphine

Introduction

Kanzawa spider mite, *Tetranychus kanzawai* KISHIDA, which is unknown in the USA, is a major pest of fruits and vegetable in Japan. The US plant quarantine regulation requires quarantine treatments for fruits infested with this pest. A combined treatment of cold storage and methyl bromide fumigation for export apples to the US had been developed by KAWAKAMI *et al.* (1994). Disinfestation tests for grapes have been carried out with methyl bromide fumigation. However, it was found that grapes are less tolerant to methyl bromide fumigation (IKEDA *et al.*, 1995).

A new disinfestation method against insect and arthropod pests on cut flower by mixture gas fumigation with carbon dioxide, methyl bromide and phosphine was developed by KAWAKAMI *et al.* (1996). The pests on cut flowers were killed completely at dose of methyl bromide (10 g/m^3), phosphine (3 g/m^3) and carbon dioxide (5%) at 15°C for 4 hours or at 20°C for 3 hours. No damage was confirmed on grapes fumigated with methyl bromide and phosphine except carbon dioxide by IKEDA *et al.* (unpublished data).

We report the results of comparative efficacies against the Kanzawa spider mite between the data reported by KAWAKAMI *et al.* (1996) and mixture gas of methyl bromide (10 g/m^3) and phosphine (3 g/m^3) except carbon dioxide (5%) at 15°C.

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Materials and Methods

1. Test Arthopod pests

Kanzawa spider mite was reared on kidney beans leaves at 25°C, 70% R. H. with a 16L: 8D photoperiod. Fifteen females were placed on a leaf in a petri dish containing agar medium with 20 ppm crystal violet. These adults were removed after two days and held under the rearing condition for 2, 7, 9 and 12 days to obtain eggs, larvae, protonymphae, deutonymphae and adults, respectively.

These infested leaves were stored overnight at the fumigation temperature.

2. Fumigation

Fumigation was conducted in a 29.5 liter fiberglass chamber (26.0 cm × 28.0 cm × 41.0 cm in size) equipped with a circulation fan, ventilation apparatus, and ports for gas application and sampling, and temperature probes. Infested larvae in petri dishes were placed in the chamber.

Methyl bromide (10 g/m^3) was injected into the chamber using gas tight syringe. Phosphine (purity: 10%, Nitrogen: 90%) in cylinder was filled in a syringe controlling gas, and then injected into chamber. The gas was circulated by using pump of the syringe. The time of fumigation was performed for 20, 40, 60, 80, 100, 120, 140, 180 and 240 minutes at 15°C.

Gas concentrations were determined with a gas chromatograph (FID for methyl bromide and TCD for phosphine, Shimazu) in accordance with the method by AKAGAWA *et al.* (1995).

Temperature were monitored by a multi-channel automatic temperature recorder (Hybrid recorder; AH, Chino). Air-fumigant mixture was exhausted for one hour by ventilation apparatus after fumigation.

3. Evaluation of mortality

After following fumigation all mites were held under the rearing condition. The mortality of eggs were determined by counting the number of eggs hatched every 2–3 days for 1–2 weeks. The other stages were assessed by stimulating with a paint blush under the microscope. Dose and expose time-mortality data was analyzed by probit procedure using Finney's formula (Finny, 1971). The probit calculation was performed using a computer program (POLO-PC; LeOra Software, 1987).

Results and Discussion

The responses larvae of all stage to mixture gas fumigation are shown in Table 1. The $LT_{50's}$ for eggs,larvae, protonymphae and deutonymphae were 105.1, 70.0, 61.1 and 61.4 minutes, respectively. The $LT_{90's}$ for eggs, protonymphae and deutonymphae were 185.6, 137.5, 97.6 and 100.6 minutes, respectively. Eggs were more tolerant stage than larvae, protonymphae and deutonymphae, and killed completely at dose of 10 g/m^3 of methyl bromide and 3 g/m^3 of phosphine at 15°C for 240 minutes.

The data reported by KAWAKAMI *et al.* (1996) showed that Kanzawa spider mite eggs were the most tolerant stage among all stage of 7 species to mixture gas of carbon dioxide (5%), methyl bromide (10 g/m^3) and phosphine (3 g/m^3) at 15°C, and that was killed 100% for 4 hours and 86.5% for 3 hours (KAWAKAMI, 1996).

It could be said that the same efficacy would be observed on the Kanzawa spider mite egg when fumigated either the schedule of mixture gas fumigation with methyl bromide, phosphine and carbon dioxide or that with methyl bromide and phosphine.

Table 1. Responses of the all stages of Kanzawa spider mite, *Tetranycus kanzawai* KISHIDA, fumigated with the mixture gas of methyl bromide (10 g/m^3) and phospine (3 g/m^3) at 15°C for various exposus time

Stage	No. of tested mites	LT_{50} (95%FL) (miniutes)	LT_{90} (95%FL) (miniutes)	Minimum time obtained 100% mortality (miniutes)
Egg	3,180	105.1 (92.6–117.1)	185.6 (157.9–252.6)	240
Larva	2,702	70.0 (56.7– 80.1)	137.5 (117.9–176.4)	180
Protonymph	3,621	61.1 (53.2– 67.9)	97.6 (87.3–114.3)	140
deutonymph	2,638	61.4 (56.5– 65.8)	100.6 (93.3–110.2)	180
Adult*	2,483	—	—	180

* Probit lines could not calculated because of variance of adults data.

References Cited

AKAGAWA, T. and Y. Soma (1995) Gas Analytical Methods for Several Gases by Gas Chromatography in Fumigation Test. *Res. Bull. Pl. Prot. Japan* 31: 125–127

FINNY, D. J.(1971) Probit Analysis. Third ed. London and New York: Cambridge University Press, 333p.

IKEDA, T *et al.* (1995) Prevention of Chemical Injury of Grape 'Kyohou' Fumigated with Methyl Bromide. *Res. Bull. Prot. Japan* 31: 75–78 (in Japanese)

KAWAKAMI, F *et al.* (1994) Plant Quarantine Treatment of "Fuji" Apples for Export to The United States. *Res. Bull. Prot. Japan* 30, Part3: 49–56

KAWAKAMI, F *et al.* (1996) Disinfestation of Pest, on Cut Flowers with Gas Mixtures of Methyl Bromide, Phosphine and Carbon Dioxide. *Res. Bull. Prot. Japan* 32: 39–46

LeOra software (1987) POLO-PC, A User's Guide to Probit or Logit Analysis. Berkeley CA.

和 文 摘 要

臭化メチル及びリン化水素混合ガスに対するカンザワハダニの感受性試験

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臭化メチル（10g/m^3）及びリン化水素（3g/m^3）混合ガスくん蒸に対するカンザワハダニ全ステージ（卵，幼虫，第一若虫，第二若虫及び成虫）の感受性を調査した。卵のLT_{50}及びLT_{90}はそれぞれ105.1及び185.6分であった。卵は最も耐性があり，混合ガス240分くん蒸で完全殺虫が達成された。

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