EFFECIENCY OF FUMIGATION WITH METHYL BROMIDE AGAINST THE MANGO BUD MITE *ACERIA MANGIFERAE* AND *FUSARIUM MONILIFORME* INFESTING MANGO TREES

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Abstract

The phenomenon of vegetative and floral malformation in old mango trees as well as in mango seedlings is now common in Egypt. Obvious relationship between mango malformation and the mango bud mite, *Aceria mangiferae* and the fungus *Fusarium moniliforme* was recorded. The aim of this work is to produce mango seedlings free from these pests by using mango twigs fumigated with methyl bromide under different conditions. The results revealed that the maximum mortality (100%) of mango bud mite could be obtained by fumigation with methyl bromide for 24h at the concentrations 12.9 , 9.0 and 7.0 mg / l under the controlled temperatures 10, 20 and 30°C , respectively. If the period increased to 48 h, the concentration would be 10.3 , 7.7 and 7.7 mg/l at the previous temperatures , respectively . Maximum mortality (100%) after 24h exposure for the fungus was obtained with the concentrations 77.4 , 71.0 and 58.1 mg/l at the temperatures 10,20 and 30 °C , respectively.

If this period increased to 48 h, the respective concentrations would be 71.0 , 64.6 and 51.6 mg/l.

INTRODUCTION

Floral and vegetative malformation phenomenon in mango trees in Egypt was considered one of the most important problems causing servere deterioration of mango production. The mango bud mite, *Aceria mangiferae* and the fungus,

Fusarium moniliforme were the main cause for such phenomenon (Summanwar 1967; Raychudhri 1968; kodirah 1969; Osman 1975; Wahba and El-Emany, 1984; Wahba *et al.*, 1984; wahba *et al.*, 1984 b). Many attempts were made to control the mango bud mite and the fungus by spraying the malformed trees with various acaricides and fungicides but all attempts failed .

The aim of the pesent work is to investigate the effect of fumigation with methyl bromide on *Aceria mangiferae* in mango buds and *fusarium moniliforme* inside mango tissues. Reaching a dose that kills 100% of both the mite and the fungus would be an excellent means to produce seedlinge free from both pests . Mango trees free from malformation are the product of sound seedlings.

MATERIALS AND METHODS

Series of small twigs 20cm each carrying terminal closed bud were cut from Combania variety malformed mango trees derived from Barrage , Qalubia Governorate for fumaigation with methyl bromide . The fumitaria used for methyl bromide were 5 litre capacity glass containers with rubberized metal screw lids. A perforation about 2 mm in diameter was made in the center of the metal lid to enable injecting the dose through the rubber lining by the needle of a gastight syringe. Methyl bromide was drawn directly into the syringe as it evolved as a gas through a rubber tube attached to the top of a container of liquid methyl bromide. Before dosing, the above mentioned reservior containing the liquid methyl bromide was taken out from the freezer and left outside to reach room temperature. Dosing was then achieved by the use of gas tight glass syringe of appropriate size following the technique described as tentative methods for adults of some major pest species of stored cereals as recommended by FAO in 1975 .

The volume , d 1 (ml) of methyl bromide vapour at 25 ^{o}C required to obtain a certain concentration X_1 (mg/l) in a fumigation chamber of a defintie voulume V_1 (l) was calculated as follows:

$$\frac{298 \times X_1 \text{ (mg/l)} \times V_1 \text{ (1)} \times 22.414 \times 1000}{273 \times 1000 \times 94.939 \text{ (GMW methyl bromide)}} = d1 \quad (m1)$$

i.e. X_1 (mg/l) x V_1 (1) x 0.2577 = d_1 (m1)

About 20 twigs (carrying 20 buds) were placed in each glass container for

each fumigation dose. After fumigation , the glass containers were put inside an incubator under constant temperatures of 10,20 or 30 ^{o}C and for the exposure periods 24 or 48 h.

The twigs were then examined under a stereoscopic microscope to investigate the effect of fumigation on bud mite. The number of moving stages of eriophyid mite was determined as well as percentage morthality. To determine the effect of fumigation on Fusarium, transverse sections from the stocks were made and inoculated after being sterilized with sodium hypochlorite 1 % for10 minutes in PDA medium placed in petridishes. Six days from inoculation, the percentage reduction of Fusarium as compared with the control was calculated.

The levels of methyl bromide concentration tested were chosen to cover a useful range of mortalities between 20 to 100% . This choice was based on the results of preliminary tests carried out before starting the actual work.

RESULTS AND DISCUSSION

Table 1 shows the effect of fumigation with methyl bromide on *Aceria mangiferae* after 24 and 48 h of exposure at different temperatures . It is evident that the percentage reduction of bud mite population increased by increaseing the concentration, temperature and the period of xposure .

When the period of exposure was 24 h, reduction percent of mite population was 5.7 % at the dosage 1.3 mg/l, and reached its maximum (100%) at the dose 12.9 mg/l under the temperature 10 ^{o}C. When the temperature increased to 20 ^{o}C the percentage reduction ranged between 1.3 and 9.0 mg/l, respectively. At 30 ^{o}C the concentration which gave 100% mortality of the bud mite was 7.7 mg/l.

When the period of gas exposure increased to 48 h, the percentae reduction of *A . mangiferae* was 21.7 % at the concentration 1.3 mg/l under 10 ^{o}C. Increasing the temperature to 20 ^{o}C , the percentage reduction of the mite ranged between 27.7 % and 100% at the concentrations 1.3 and 7.7 mg/l, respectively. At 30 ^{o}C, the concentration which gave 100% kill to the bud mite population was 7.7 mg/l

In general the maximum mortality (100%) of the mango bud mite *E. mangiferae* was obtained by fumigation with methyl bromide for 24 h at the concentrations 12.9, 9.0 and 7.7 gm/l at the themperatures 10, 20 and 30^{o}C, respectively . When

Table 1. Effect of fumigation with methyl bromids on *Aceria mangiferae* afrer 24 and 48 h of exposure at diferen temperatures.

Dosage mg/l	Period of exposure	No. of alive bud mite /20 mango buds					
		10 °C	% Red.	20 °C	% Red.	30 °C	% Red.
Control	24 h	405	–	317	–	388	–
1.3		382	5.7	290	8.5	277	28.6
2.6		366	9.6	281	11.4	211	45.6
3.9		314	22.5	236	25.6	154	60.3
5.2		251	38.0	156	50.8	98	74.7
6.5		223	44.9	124	60.9	47	87.9
7.7		197	51.4	54	83.0	–	100.0
9.0		135	66.7	–	100.0	–	100.0
10.3		88	78.3	–	100.0	–	100.0
11.6		43	89.4	–	100.0	–	100.0
12.6		—	100.0	–	100.0	–	100.0
Control	48 h	392	–	303	–	369	–
1.3		307	21.7	219	27.7	233	36.9
2.6		284	27.6	192	36.6	198	46.3
3.9		233	40.6	123	59.4	127	65.6
5.2		204	48.0	62	91.1	57	84.6
6.5		177	54.8	27	100.0	22	94.0
7.7		108	72.5	–	100.0	–	100.0
9.0		67	82.9	–	100.0	–	100.0
10.3		–	100.0	–	100.0	–	100.0

Red . = Percentage of reduction.

Table 2. Effect of fumigation with methyl bromide on *Fusarium moniliforme* afrer 24 and 48 h of exposure at diferen temperatures.

Dosage mg/l	Period of exposure	No. of alive bud mite /20 mango buds					
		10 °C	% Red.	20 °C	% Red.	30 °C	% Red.
Control		16	–	14	-	12	–
12.9		13	18.8	11	21.4	9	25.0
19.4		12	25.0	10	28.6	8	33.3
25.8		12	25.0	9	35.7	7	41.7
32.2		11	31.3	7	50.0	5	58.3
38.7		9	43.8	6	57.1	5	58.3
45.2	24 h	9	43.8	6	57.1	3	75.0
51.6		7	56.3	5	64.3	1	91.7
58.1		4	75.0	3	78.6	–	100.0
64.6		4	75.0	2	85.7		
71.0		1	93.8	–	100.0		
77.4		–	100.0				
Control		15	–	13	-	11	–
12.9		12	20.0	10	23.1	8	27.3
19.4		10	33.3	8	38.5	6	45.5
25.8		10	33.3	8	38.5	5	54.5
32.2		9	40.0	6	53.8	3	72.7
38.7		7	53.3	5	61.5	2	81.8
45.2	28 h	6	60.0	3	76.9	1	90.9
51.6		6	60.0	2	84.6	–	100.0
58.1		4	73.2	2	84.6		
64.6		2	86.7	–	100.0		
71.0		–	100.0				
77.4							

Red . = Percentage of reduction.

the period of exposure was increased to 48 h, the maximum reduction in mite population (100%) was obtained with the concentration 10.3, 7.7 and 7.7 mg/l at the temperatures 10,20 and 30 °C, respectively.

Table 2. shows the effect of fumigation with methyl bromide on the fungus *Fusarium moniliforme* after 24 and 48h of exposure at different temperatures.

It is evident that percentage reduction of the fungus growth increased by increasing the concentration , temperature and the periood of exposure.

When the period of xposure was 24 h, percentage reduction of the fungus growth reached 18.8 with the dose 12.9 mg/l and reached 100% with the dose 77.4 mg/l at 10 °C. Increasing the temperature to 20 °C , the percentage reduction ranged between 21.4 % and 100% with the concentration ranging between 12.9 and 71.0 mg/l, respectively. At 30 °C the concentration 58.1 mg/l produced 100% kill.

When the period of eposure was increased to 48 h, the percentage reduction of fungus growth was 20% at the concentration 12.9 mg/l and recached its maximum (100%) with the dose 71.0 mg/l at 10 °C. Increasing the temperature to 20 °C , the percentage reduction of the fungus ranged between 23.1 % and 100% with the concentration 12.9 and 64.6 mg/l, respectively. At 30 °C, the concentration 51.6 mg/l produced 100% kill.

In conclusion, complete inhibition of fungus growth was obtained by fumigation with methyl bromide for 24 h at the concentrations 77.4 , 71.0 and 58.1 mg/l under the controlled temperatures 10, 20 and 30 °C , respectively . When the period of exposure was increased to 48 h the maximum inhibition of fungus gowth was achieved with the centrations 71.0 , 64.6 and 51.6 mg/l at the temperatures 10, 20 and 30 °C respectively.

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كفاءة التبخير بغاز بروموميثايل ضد أكاروس براعم المانجو *Aceria mangiferae* والفطر *Fusarium mangiferae* الذي يصيب أشجار المانجو

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تصاب أشجار المانجو الكبيرة وكذلك شتلات المانجو الصغيرة بظاهرة تكتل الشماريخ الزهرية والخضرية . وقد وجد علاقة واضحة بين هذه الظاهرة وأكاروس براعم المانجو *Aceria mangiferae* والفطر *Fusarium moniliforme*.

والهدف من هذا البحث هو إنتاج شتلات مانجو خالية من الإصابة بالآفتين السابقتين وهما أكاروس براعم المانجو والفطر فيوزاريوم وذلك باستخدام عقل من أشجار المانجو يتم تبخيرها بغاز بروميد الميثايل تحت ظروف معملية مختلفة. وقد وجد أن أعلي نسبة موت (١٠٠٪) لأكاروس براعم المانجو أمكن الحصول عليها بالتبخير بغاز بروموميثايل بتركيزات ١٢,٩ ، ٩,١ ، ٧,١ ملجم / لتر عند درجات الحرارة المختلفة ١٠، ٢٠، ٣٠ مْ علي التوالي مع فترة تعريض لمده ٢٤ ساعة. وبزيادة فتره التعريض الي ٤٨ ساعة فان تركيز الغاز اللازم للحصول علي نفس النسبة السابقة من الإبادة كان ١٠,٣ ، ٧,٧ ، ٧,٧ ملجم / لتر تحت درجات الحراره السابق الإشارة اليها علي التوالي . وأما بالنسبه للفطر فقد أدي التعرض للغاز إلي حدوث نسبه موت ١٠٠٪ عند التركيزات المختلفة ٧٧,٤ ، ٧١,٠ ، ٥٨,١ كلجم / لتر عند درجات الحراره ١٠، ٢٠، ٣٠ مْ علي التوالي مع فترة تعريض لمدة ساعة . وبزيادة فترة التعريض الي ٤٨ ساعة فان تركيز الغاز المستعمل الذي أعطي نفس النتيجة كان ٧١,٠ ، ٦٤,٦ ، ٥١,٦ ملجم / لتر تحت درجات الحرارة ١٠ ، ٢٠، ٣٠ مْ علي التوالي.