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The Infestation and Control of Bulb Mite (*Rhizoglyphus robini*) on Gladiolus[1]

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Abstract : Bulb mite (*Rhizoglyphus robini* Claparede), the most serious pest on gladiolus, attacks gladiolus corms both in the field and in storage. About 78.6%, 90.0%, 80.0% and 54.2% of the gladiolus corms were found to be damaged by this mite when the plants were at 5-leaf, 7-leaf, corm-mature and corm-harvest stage, respectively. The number of mites found on the damaged corms in the field ranged from 4 to 540. During the corm storage period, 97.9% of the animal pests was the bulb mite. Only 55.5% of the corms were left healthy after stored for three months under laboratory conditions (15-28°C, 51-87% RH).

Dip treatment and fumigation treatment were tested for the control of the bulb mite. In dip treatment, chlorobenzilate, dicofol, tetradifon, triazid, azide, propargite, oxythioquinox, cyhexatin, bromopropylate, benzomate, cycloprate, azinphos-methyl, mecarbam, methyl demeton, methomyl, carbofuran, drawin, and oxamyl were tested. Of them, bromopropylate, benzomate, and methyl demeton had the best control effect on bulb mite. Fumigation of the bulb-mite-infested corms with 55% aluminum phosphide tablet (1 tablet : 3 gram) at the dosage of 1 tab/m^3 for 48 hours killed all the bulb mites when the temperature in the fumigation container ranged from 25-38°C. The dosage increased to 2 tab/m^3 when the temperature in the container ranged from 15-20°C.

Results of the observations made in Hor-li, the main commercial gladiolus growing area in Taiwan, and on the experimental field of the Taiwan Agricultural Research Institute in Taichung during the past few years indicate that gladiolus corms were usually infested with the bulb mite (*Rhizoglyphus robini* Claparede)[8]. The attack of bulb mite on corms or bulbs of plants such as amaryllis, crocus, lily, tulip, narcissus, hyacinth, garlic and onion has been found to take place both in the field and in storage[3]. Usually, the infestation of bulb mite follows the physical damage of tissue caused by other insects, pathogens, nematodes, or mechanical injuries[1,2,3,4,7]. The existence of bulb mite hasten the decay and make corms or bulbs completely destroyed even when the corms or bulbs would otherwise stand a very good chance

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of recovery[3]. The injuries caused by this mite appears much more serious than any other pests so far known to attack the gladiolus corms[8]. Once infested with the bulb mite, the plant growth is greatly checked. Plants turn to yellow and present a general sickly appearence. The leaves of such plants are stunted and distorted, and the plant will generally fail to produce flowers or will produce only misshapen ones[6].

Field surveys and laboratory observations were made at TARI in 1981 and 1982 to study the occurrence and infestation of the bulb mite on stored gladiolus corms as well as the corms of growing gladiolus in the field. Besides, Trials were carried out to evaluate the effectiveness of certain chemicals for the control of this pest.

Methods and Materials

I. Survey of infestation in field and in storage

Studies on field infestation of bulb mite on gladiolus corms were made at four seperated gladiolus nurseries with plants at various growth stages from 35 to 92 days after planting. Samplings were made by randomly dug out 40 gladiolus corms from each nursery. These corms were then bring back to laboratory for evaluation of percentage of damage. The bulb mite on the corms were collected by placing these corms in cylinder extractor for 24 hours. The densities of the mite in four nurseries were calculated. The corms stored in laboratory under room conditions, 15-28°C and 51-87% RH, for three months from February 2 to May 4, 1982 were examined. The population of bulb mite and other pests on the stored corms and the damage of these corms were also investigated.

II. Control by dip treatment

Eighteen commercially formulated chemicals including chlorobenzilate, dicofol, tetradifon, triazid, azide, propargite, oxythioquinox, cyhexatin, bromopropylate, benzomate, cycloprate, azinphos-methyl, mecarbam, methyl demeton, methomyl, carbofuran, drawin, and oxamyl were tested. Chemicals were diluted to 1000, 2000, 4000 and up to 50000 times according to their active ingredient. Bulb mites were collected with a small soft brush and transferred in to a petri dish (dia. 5 cm). Diluted acaricides or insecticides were poured into these dishes, then the mites were immersed for 30 minutes or 60 minutes. At the end of dipping, the test mites were seperated from the poisoned fluid with a Bunnel's funnel; the mortality counts of the tested mites were made immediately. Each treatment was repeated three times. Bulb mite dipped in water for the same time was used as check. Influence of these chemicals on germination of the corms was observed.

III. Control by fumigation treatment

The corms infested with bulb mites placed in a air-tight container (1×1×1 m) were fumigated with 55% aluminum phosphide at different concentrations for varied period of time. The fumigation tests were conducted in May and June, 1981 when the temperature in fumigation container varied from 25-38°C, and in February, 1982 when the temperature in fumigation container ranged from 15-20°C. The bulb

mites on corms were examined using an anascope after fumigation, and the mortality counts were made. These corms were examined again seven days after fumigation to find whether there were any larvae or nymphs that have hatched from the eggs that were not destroyed by the previous fumigation.

Results

I. Survey of infestation in field and in storage

Corms collected from all four nurseries were from moderately to seriously infested with bulb mite (Table 1). This suggests that corms of gladiolus of all growth stages might be susceptable to the attack of bulb mite. Corms sampled from nurseries A, B, C where gladiolus were continuously planted for at least two seasons were observed to be infested by this mite at 78.6%, 90.0%, and 80.0%, respectively, whereas a newly planted field, nursery D, with rose as proceeding crop, had relatively lower percentage of infestation that was 54.2%. Number of mites found on the damaged corms in these nurseries ranged from 4 to 540 and the average ranged from 57.0 to 104.7 in various nurseries.

Bulb mite reproduced rapidly on laboratory stored corms. A total of 10,705 bulb mites were collected by cylinder extractor from 45 corms after storing for three months. The number of other insect pests such as *Drosophila* sp. , *Panafennis* sp. and beetles and moths was 225 which was only 2.1% of the bullb mites. There were 25 corms to be observed empty and dried out which were caused by bulb mite damage.

II. Control by dip treatment

One-thousand-time diluted chlorobenzilate, tetradifon, triazid, bromopropylate, benzomate, methyl demeton resulted in 100% mortality of bult mites under 30 minutes dipping (Table 2). For the same dipping period, completely killing of the pest was not observed with 2000 and 4000 times diluted chlorobenzilate, tetradifon, and triazid while for bromopropylate, benzomate and methyl demeton, 100% mortality was not obtained when diluted 4000 times. By further testing, we found that the lowest concentrations resulting in 100% mortality of bulb mite for bromopropylate, benzomate and methyl demeton was 30000, 4000, and 4000 dilution times, respectively (Figure 1).

Table 1. Survey of bulb mite infestation at four seperate gladiolus nurseries in TARI experimental farm and greenhouse, 1982.

Nursery	Proceeding crop	Days after planting	Plant growth stage	Bulb mite damaged corm (%) [a]	Avg. no. of bulb mite per damaged corm	
					Mean	Range
A	Gladiolus	23	5-leaf	78.6	57.0	6—540
B	Gladiolus	50	7-leaf	90.0	104.7	6—105
C	Gladiolus	73	corm-mature	80.0	79.7	4—340
D	Rose	92	corm-harvest	54.2	64.2	8—154

[a] forty corms were examined in each nursery

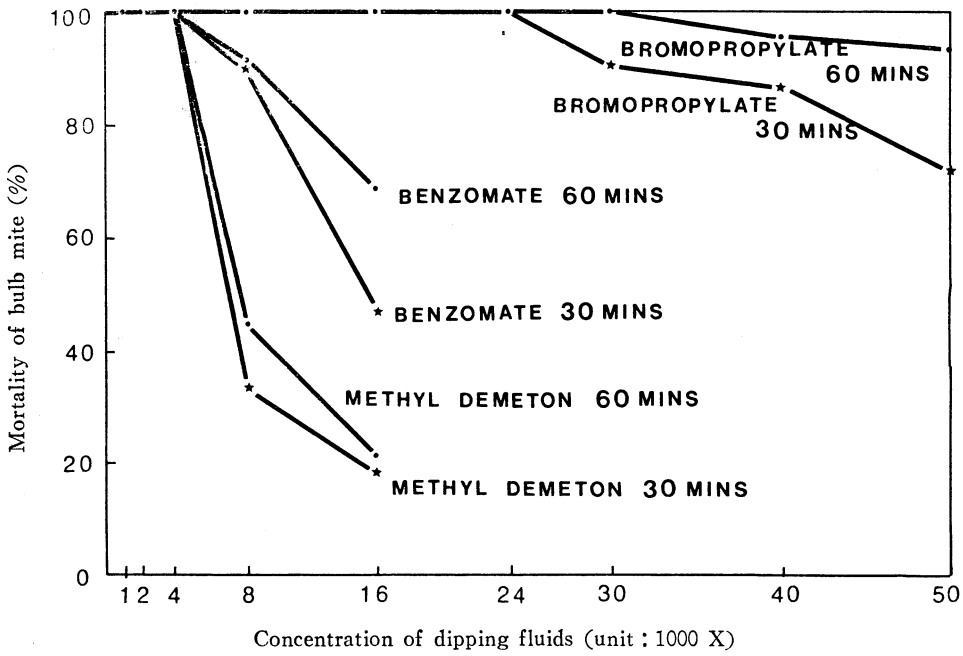

Figure 1. Comparison of the mortalities (%) of bulb mite after being dipped in various pesticide at various concentrations for 30 and 60 minutes.

Propargite, oxythioquinox, cyhexatin, cycloprate, mecarbam and carbofuran were not satisfied in controlling bulb mite. None of these chemical agents resulted in 100% mortality of bulb mite after both 30 and 60 minutes dipping (Table 2, 3).

Another set of trials revealed that germination ability of corm was not adversely affected by dipping treatment of any of the pesticides tested.

Table 2. Mean mortality (%) of bulb mite after being dipped in various pesticide for 30 minutes. [a]

Pesticide	Formulation	Conc. of dipping fluid					
		1000 X		2000 X		4000 X	
		Mortality	SE	Mortality	SE	Mortality	SE
Chlorobenzilate	25.5 EC	100.0	0.0	91.6	3.3	73.3	1.7
Dicofol	45 EC	93.9	5.6	81.6	6.5	60.0	8.0
Tetradifon	7.6 EC	100.0	0.0	89.8	0.3	75.0	2.9
Triazid	20 EC	100.0	0.0	96.6	1.7	88.3	6.0
Azide	55 EC	97.2	3.0	92.7	3.2	38.8	4.3
Propargite	57 EC	83.2	5.6	59.6	2.5	43.6	2.7
Oxythioquinox	25 WP	1.2	1.6	2.0	1.6	0.0	0.0
Cyhexatin	50 WP	66.6	4.4	66.6	7.3	70.0	10.4

Bromopropylate	20 EC	100.0	0.0	100.0	0.0	100.0	0.0
Benzomate	20 EC	100.0	0.0	100.0	0.0	100.0	0.0
Cycloprate	30 EC	63.3	16.9	65.3	11.1	34.0	11.6
Azinphos-methyl	20 EC	99.2	0.7	98.7	0.7	97.2	1.3
Mecarbam	35 EC	90.3	1.2	71.6	8.2	44.2	11.7
Methyl demeton	25 EC	100.0	0.0	100.0	0.0	100.0	0.0
Methomyl	24 EC	88.3	1.7	83.3	1.5	75.3	0.3
Carbofuran	25 WP	68.5	7.0	53.1	2.8	65.4	15.8
Drawin	50 EC	99.0	1.0	94.0	3.7	69.0	6.7
Oxamyl	24 EC	92.0	3.4	92.8	4.3	90.3	5.5

[a] Dipping fluid were prepared by diluting the pesticides 1000, 2000 and 4000 times to the active ingredient.
All the treatments were replicated 3 times.

Table 3. Mean mortality (%) of bulb mite after being dipped in various pesticide for 60 minutes. [a]

Pesticide	Formulation	Conc. of dipping fluid					
		1000 X		2000 X		4000 X	
		Mortality	SE	Mortality	SE	Mortality	SE
Chlorobenzilate	25.5 EC	100.0	0.0	100.0	0.0	78.3	1.7
Dicofol	45 EC	100.0	0.0	100.0	0.0	82.9	2.5
Tetradifon	7.6 EC	100.0	0.0	98.0	1.7	100.0	0.0
Triazid	20 EC	100.0	0.0	100.0	0.0	93.3	3.3
Azide	55 EC	100.0	0.0	91.4	4.8	83.7	4.0
Propargite	57 EC	74.6	15.8	57.7	5.1	22.3	20.1
Oxythioquinox	25 WP	3.3	4.4	0.0	0.0	6.3	2.7
Cyhexatin	50 WP	83.3	8.3	63.3	1.7	75.0	12.6
Bromopropylate	20 EC	100.0	0.0	100.0	0.0	100.0	0.0
Benzomate	20 EC	100.0	0.0	100.0	0.0	100.0	0.0
Cycloprate	30 EC	65.0	12.7	48.3	8.5	59.3	7.5
Azinphos-methyl	20 EC	100.0	0.0	100.0	0.0	97.9	1.0
Mecarbam	35 EC	88.0	2.0	80.9	7.8	43.7	17.0
Methyl demeton	25 EC	100.0	0.0	100.0	0.0	100.0	0.0
Methomyl	24 EC	96.0	4.7	96.6	3.7	81.7	7.3
Carbofuran	75 WP	54.1	1.0	60.8	23.7	55.2	6.4
Drawin	50 EC	100.0	0.0	93.0	4.9	91.4	3.9
Oxamyl	24 EC	97.1	2.4	91.1	4.8	70.1	1.7

[a] Dipping fluid were prepared by diluting the pesticides 1000, 2000 and 4000 times to the active ingredient.
All the treatments were replicated 3 times.

III. Control by fumigation treatment

Tests conducted in May and June of 1980 in the fumigation container where temperature varied from 25-38°C showed that fumigation of the infested corms with 55% aluminum phosphide tablet (1 tablet : 3 gram) at the rate of 1 tab/m^3 for 24 hours did not give complete kill of the bulb mite, but when the dosage was increased to 2 tab/m^3 or 4 tab/m^3, 100% kill of the adult, nymphal and larval bulb mite was obtained. However, some of the eggs survived these treatments from which the larvae had hatched seven days later (Table 4). Fumigations of the corms with aluminum phosphide at the dosage of 1/2 or 1 tab/m^3 for 48 hours also gave 100% kill of the adults and nympns and larvae. Following these 48-hour treatment, the treated corms were again examined seven days later ; only some newly hatched larvae were found on the corms treated with this chemical at the dosage of 1/2 tab/m^3, while no living mites were found on the corms treated with the dosage of 1 tab/m^3. The fumigated corms did not lose their germination ability.

Table 4. Effects of fumigation of 55% aluminum phosphide tablet on the control of the bulb mite on gladiolus corms when the temperature in fumigation container varied from 23-38°C.

Fumigation period	Dosage (tab/m^3)	Avg . no. of bulb mite/corm[a]	
		One DAF[b]	Seven DAF
24 hours	1	284	225
	2	0	24
	4	0	0
48 hours	1/4	252	271
	1/2	0	102
	1	0	0

[a] Twenty corms were examined in each treatment
[b] DAF : day after fumigation

Tests were repeated in February of 1981 when the temperature on the container dropped to 15-20°C. The results indicated that to obtian 100% kill of all the stages of the bulb mite, the dosage had to be increased to 2 tab/m^3 when the fumigation time being 48 hours (Table 5).

Table 5. Effects of fumigation of 55% aluminum phosphide tablet on the control of the bulb mite on gladiolus corms when the temperature in fumigation container varied from 15-20°C.

Fumigation period	Dosage (tab/m^3)	Avg . no. of bulb mite/corm[a]	
		One DAF[b]	Seven DAF
48 hours	1/2	574	592
	1	33	29
	2	0	0

[a] Twenty corms were examined in each treatment
[b] DAF : day after fumigation

Discussion

Gladiolus corms harvested from field usually bring bulb mites which stay alive on stored corms and reproduce rapidly if the environment is favorable. Adaptable control measures of these bulb mites before planting would eliminate the possibility of their occurrence and infestation.

To decide which method should be adopted to control the bulb mite, one should consider the amount and the stage of the corms to be treated and the scheduled planting time. Dip treatment is convenient for corms in small amount and is suitable for the hibernated corms. Since the corms which have passed their hibernation period would germinate upon the contact of water in warm weather, once these corms are dipped, the following storage would be very difficult. Fumigation treatment can be applied at any stage of the corm and their subsquent storage is permissible.

All the data obtained in this experiment were based on the responses of the bulb mite in normal forms. Few hypopal nymphs were observed during the experimental period, their response to the chemicals were not included in this report.

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唐菖蒲球莖蠕 (*Rhizoglyphus robini*) 之爲害與其防治

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摘 要

球莖蠕 (*Rhizoglyphus robini* Claparede) 爲唐菖蒲種球栽植時期與儲存時期爲害最嚴重之害蠕，田間栽植之唐菖蒲生育至5葉期、7葉期、種球成熟期及種球收穫期分別有78.1%，90.0%，80.0%及54.2%之種球被球莖蠕爲害，被害球上之蠕數自4至540隻。種球在試驗室內 (15—28°C, 51—87%pH) 儲存3個月後，發現其上之有害動物有97.9%爲球莖蠕，健全種球僅餘44.4%。

防治球莖蠕之方法包括浸漬處理與燻蒸處理。浸漬處理共試驗了 18 種藥劑，包括 chlorobenzilate, dicofol, tetradifon, benzomate, cycloprate, triazid, azide, propargite, oxythioquinox, cyhexatin, bromopropylate, azinophos-methyl, mecarbam, methyl demeton, methomyl, carbofuran, drawin, oxamyl。其中以 bromopropylate, benzomate, methyl demeton 效果最優良。若以燻蒸處理，燻蒸箱溫度爲 25—38°C 時，以每立方公尺一片 (3 g) 之 55% aluminum phosphide 燻蒸被害之種球48小時，可消滅所有之球莖蠕，當箱內溫度降至 15—20°C 時，用藥量應提高至每立方公尺2片。

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