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Fosphite is a botanical systemic fungicide used for controlling downy mildew disease as well as ***Phytophthora*** and ***Pythium*** fungi. The fungicide was tested against the downy mildew on grapevine, cucumber and pepper. It was also tested against root rot on citrus seedlings, as a soil drench, and against gummosis disease on lemon trees as a foliar spraying.

Disease	Crop	Pathogen Species	Application
Downy	Grapevine	*Plasmopara viticola*	Foliar
Downy	Pepper	*Pseudo peronospora cubensis*	Foliar
Downy	Cucumber	*Pseudo peronospora cubensis*	Foliar
Root Rot	Citrus	*Phytophthora & Pythium*	Soil drench
Gummosis	Citrus	*Phytophthora spp.*	Foliar

Downy mildew caused by ***Plasmopara viticola***, usually occurs in most of the grapevine orchards in Egypt and causes serious economic damage. Under Egyptian environmental conditions, the disease attacks the fruits and leaves at the end of the season and causes high losses in yield. Therefore, using effective fungicides to control the diseases is highly recommended.

MATERIALS AND METHODS

- **Location:** Sharkia Governorate (the Delta).
- **Host Plant:** Grapevine (King robi Var.)
- **Target Pest:** ***Plasmopara viticola,*** downy mildew species attacking grapevine.

Procedure: The Fosphite fungicide was used at the recommended spraying times. Rate of Fosphite application was 2 L. / 400 L. water. Four sprayings were applied at two weeks intervals; on 1st, 15th, 30th of July and 15th of August 2001. The 1st spraying was applied before the presence of any disease symptoms. Twenty young trees almost uniform in size, growth vigor and age were selected randomly for experimentation. A replicate consisted of five trees. The same number of trees was left untreated and used as a control. Vines were hand-sprayed to run-off ensuring good distribution of Fosphite over the upper and lower leaves' surfaces of grapevine plants.

Sampling was carried out 15 days after spraying and the efficiency of the control was measured according to the scale described by **Tounsend and Heuberger (1943)** as follows:

0- Healthy leaves (no infection at all).
1- 5 % infected surface
2- 5.1 - 10 % infected surface
3- 10.1 – 15% infected surface
4- 15.1 – 25 % infected surface
5- 25.1 – 50 % infected surface
6- 50.1 – 75 % infected surface
7- 75.1 - 100% infected surface

Assessment of the efficacy of Fosphite was estimated by examining a fixed number of leaves (50 leaves / Rep.) treated with Fosphite, to determine the extent of infection on the leaf surface. Percentage of infection as well as the infected area per leaf was estimated according to **Michael (1962).**

$$\% \text{ Infection} = \frac{\text{Number of infected leaves}}{\text{Total number of leaves}} \times 100$$

$$\% \text{ Infected area per leaf} = \frac{\text{Infected area}}{\text{Total area}} \times 100$$

$$\text{Efficiency} = \frac{\text{Control} - \text{Treatment}}{\text{Control}} \times 100$$

RESULTS AND DISSCUSSION

Data summarized in table (1) indicated that Fosphite was used four times to control downy mildew on grapes. First spraying was applied at zero infection. Percentages of the disease incidence, before the 2nd spraying, were 68, 72,76 and70 % for the replicates, with an average of 71.5%. Meanwhile the percentage of disease incidence in the control trees was 64%.

Table (1): Effect of Fosphite fungicide (2 L./400L.water) on Downy Mildew on Grapes in Egypt, year 2001

Replicate	Applications			
	1st	2nd	3rd	4th
	% infection	% infection	% infection	% infection
R_1	0	68	50	22
R_2	0	72	34	10
R_3	0	76	40	6
R_4	0	70	32	12
Control	**0**	**64**	**82**	**94**

Average of infected leaf surfaces $R_1 = \frac{1187.10}{150} = 7.91$

Average of infected leaf surfaces $R_2 = \frac{992.6}{150} = 6.61$

Average of infected leaf surfaces $R_3 = \frac{1327.25}{150} = 8.84$

Average of infected leaf surfaces $R_4 = \frac{1333.5}{150} = 8.89$

X 1 Treatment $= \frac{32.25}{3} = 10.75$

Average of infected leaf surfaces Control = $\frac{5693.5}{150} = 37.95$

Fungicide Efficiency = $\frac{37.95 - 10.75}{37.95} X100 = 71.6\%$

Before the 3rd spraying, the percentages of the disease incidence reduced to 50, 34, 40 and 32% for the replicates, with an average of 39%. Meanwhile, the percentage of the disease incidence in the control trees was 82%.

Before the 4th spraying, the percentages of the disease incidence reduced sharply to 22, 10, 6 and 12% for the replicates, with an average of 10%. While the percentage of the disease incidence in the control trees reached 94%.

Data also showed that Fosphite reduced the highest percentage of the disease incidence from 76% to 6% which means that the fungicide was very efficient, therefore, some trees inside the replicates showed disappearance of the disease incidence.

Conclusion

- Fosphite, the systemic fungicide, at the recommended dose (2 L. / 400 L. water), was effective to control the downy mildew on grapevine trees by 71.6% under Egyptian conditions.
- The negative observation in the experiment, was the recovery of the disease when the humidity and temperature increased during July and August, although the trees were treated with the fungicide.

Downy mildew, caused by ***Pseudoperonospora cubensis,*** heavily attacks pepper plants in the field as well as in the greenhouse and usually causes economic damage.

MATERIALS AND METHODS

- **Location:** Menoufia governorate (the Delta).
- **Host Plant:** Green Pepper.
- **Target Pest:** ***Pseudoperonospora cubensis,*** downy mildew species attacking green pepper.

Procedure: Fosphite was used at the rate of 1L. / 400 L. water. Three sprayings were applied at two weeks intervals; on 28th of June, 13th and 28th of July 2001. Twenty-five plants almost uniform in size and growth were selected for the Fosphite treatments and each replicate consisted of five plants. The same number of plants was left untreated and used as a control. Pepper plants were hand-sprayed to run-off ensuring good distribution of the fungicide.

Plants were examined 15 days after spraying and the degree of control was estimated as mentioned before in grapevine (M & M). Ten leaves / plant were examined to determine the extent of infection in the leaf surfaces.

RESULTS AND DISSCUSSION

Data presented in table (2) showed that Fosphite was used four times to control the downy mildew on pepper. The first spraying was applied when the infection was zero. Data also showed that the percentages of the disease incidence before the 2nd spraying were 70, 58, 60, 38 and 66% for the replicates, with an average of 58.4%. At the same time, the percentage of disease incidence in the control trees was 72%. Before the 3rd spraying, the percentages of disease incidence reduced sharply to 34, 18, 24, 22 and 32%. for the replicates, with an average of 26%. Meanwhile, the percentage of the disease incidence in the control trees reached 78%. Before the 4th spraying, it was found that the oil spots completely disappeared and the maximum percentage of disease incidence was 0.6%. The respective disease incidence in the control trees was 94.0%.

Table (2): Effect of Fosphite fungicide (1L./400 L. water) on Downy Mildew on pepper in Egypt, year 2001

Replicate	Applications			
	1st	2nd	3rd	4th
	% infection	% infection	% infection	% infection
R_1	0	70	34	0.6
R_2	0	58	18	0.0
R_3	0	60	24	0.0
R_4	0	38	22	0.0
R_5	0	66	32	0.0
Control	**0**	**72**	**78**	**94.0**

Average of infected leaf surface $R_1 = \frac{623.75}{150} = 4.15$

Average of infected leaf surface $R_2 = \frac{538.7}{150} = 3.59$

Average of infected leaf surface $R_3 = \frac{557.3}{150} = 3.71$

Average of infected leaf surface $R_4 = \frac{360.8}{150} = 2.40$

Average of infected leaf surface $R_5 = \frac{691.05}{150} = 4.60$

Mean Treatment $= \frac{18.44}{5} = 3.68$

Average of infected leaf surface $= \frac{3689.25}{150} = 24.59$

% Efficiency $= \frac{24 - 59 - 3.68}{24 - 59} \times 100 = 85\%$

Conclusion

- Fosphite, as a systemic fungicide, gave an excellent result in controlling the downy mildew on pepper plants when it was used at the rate of 1L./400L.water.
- Fungicide efficiency was 85% as final results.

Downy mildew on cucumber caused by ***Pseudoperonospora cubensis***. This disease causes serious losses in cucumber yield under Egyptian environments. Control of this disease is necessary in-order to reduce the yield losses.

MATERIALS AND METHODS

- **Location:** Menoufia governorate (the Delta).
- **Host Plant:** Cucumber
- **Target Pests:** Downy mildew species attacks cucumber, ***Pseudoperonospora cubensis***

Procedure: Fosphite, the systemic fungicide, was used as foliar spray at the rate of 2L./ 400 L. water. Three sprayings were applied at two weeks intervals, on the 28th of June, 13th and 28th of July 2001. The 1st treatment was applied before the occurrence of the disease. Twenty plants almost uniform in size and growth were selected for Fosphite treatments. Each replicate consisted of five plants. The same number of plants was left untreated and used as a control. Sampling was carried out 15 days after every spraying and the degree of control was estimated as mentioned in the grapevine (M & M). Ten leaves/plants were examined to determine the extent of infection on the leaf surfaces.

RESULTS AND DISSCUSSION

Data presented in table (3) showed that Fosphite was used four times to control the downy mildew on cucumber. Data also showed that the percentages of the disease incidence before the 2nd spraying were 69.3, 81.3, 64.0 and 69.3% for the replicates, with an average of 71.05%. Meanwhile the percentage of disease incidence in the control trees was 46.6%. Before the 3rd spraying, percentages of the disease incidence reduced to 50.6, 54.7, 41.3 and 44% for the replicates, with an average of 47.65%. While the disease incidence in the control trees was 64.0%. Before the last spraying, the percentages of disease incidence reduced sharply in all replicates to 24, 20, 16 and 16%, with an average of 19%. Meanwhile, the disease incidence in the control trees reached 72.0%.

Table (3): Effect of Fosphite fungicide on Downy Mildew of Cucumber in Egypt, year 2001

Replicate	Applications			
	1st	2nd	3rd	4th
	% infection	% infection	% infection	% infection
R_1	0.0	69.3	50.60	24.0
R_2	0.0	81.3	54.66	20.0
R_3	0.0	64.0	41.33	16.0
R_4	0.0	69.3	44.00	16.0
Control	**0.0**	**46.6**	**64.00**	**72.0**

Average of infected leaf surface $R_1 = \frac{1039.15}{225} = 4.61$

Average of infected leaf surface $R_2 = \frac{1166.4}{225} = 5.81$

Average of infected leaf surface $R_3 = \frac{984.85}{225} = 4.37$

Average of infected leaf surface $R_4 = \frac{1035.4}{225} = 4.60$

Mean Treatment $= \frac{19.39}{4} = 4.84$

Average of infected leaf surface control $= \frac{6381.85}{225} = 28.36$

Fungicide Efficiency $= \frac{28.36 - 4.84}{28.36} X100 = 82.93\%$

Conclusion

- Fosphite gave good results in controlling cucumber downy mildew at the rate of 2.L / 400 L. water.
- Fungicide efficiency was 83.0 % as final results.

[illegible]

The root rot disease is an important and economic disease and causes serious loss for the plants in either the nurseries or the orchards. Root rot disease is caused by several fungi species as: ***Phytophthora, Pythium*** and ***Fusarium***. Symptoms of the root rot disease are either wilt of the leaves that dry up in place, as in the quick collapse stage of citrus trees, or the leaves drop. By the development of the disease the trees contain more dead twigs than usual.

MATERIALS AND METHODS

- **Location:** Menoufia governorate (the Delta).
- **Host Plant:** Citrus seedlings.
- **Target Pests:** The fungi species; ***Pytophthora*** spp. and ***Pythium*** **sp**

Procedure: This experiment was carried out under greenhouse conditions. Pots of 20 cm diameter were used in this experiment. Each pot was filled with clay soil at the rate of 2.5 kg/pot. The soil was taken from one of the citrus orchards in which its trees were suffering from the symptoms of the root rot disease. Sour orange seedlings, 3 years old, were cultivated at the rate of one seedling /pot.

Fifteen seedlings with healthy roots and leaves were used and classified as follow:

1- Four pots treated with Fosphite at rate of 1L./400L.water
2- Four pots treated with Fosphite at rate of 1.5 L./400L.water
3- Four pots treated with Fosphite at rate of 2.0 L./400L.water
4- Three pots were left without treatment, used as control.

All the pots were irrigated every three days and the tested doses of Fosphite were applied, as soil drench, three times with two weeks intervals; on 14th , 28th of July and 13th of August 2001. Data were tabled and the disease symptoms if present were recorded.

RESULTS AND DISSCUSSION

Data presented in table (4) indicated that the Fosphite fungicide, at the rate of 1L./400 L. water showed minor phytotoxicity as yellowish leaves (2-3) in all treated pots, with small areas of dead branches (1-2), while the symptoms of the root rot disease disappeared completely in all the tested pots, at the rates of 1.5 and 2.0 L./400L.water. Meanwhile, in the control pots, about 10-13 leaves became yellow and about 4-5 leaves dropped. Also the control pots had a large area of die back in the branches.

Table (4): Effect of Fosphite fungicide against root rot disease on citrus seedlings in Egypt, year 2001

	Disease Symptoms	
Pot No.	**Yellow Leaves**	**Die-back**
	1 l./400l. water	
1	+	+
2	+	+
3	+	+
4	+	0
	1.5 l./400l.water	
1	0	0
2	0	0
3	0	0
4	0	0
	2.L./400L.water	
1	0	0
2	0	0
3	0	0
4	0	0
	Control	
1	+++	++
2	+++	++
3	+++	++

Key: + 1 - 5 Infected leaves or Die-back.
++ 6 - 10 Infected leaves or Die-back.
+++ > 10 Infected leaves or Die-back.

Conclusion

- Fosphite fungicide at the rate of 1.5 and 2.0 L.0/400 L. water gave the best results for controlling the root rot disease. This could also be measured by the reduction in the numbers of zoospores released given by the Fosphite.
- Fosphite, at the rate 1L.or 2.L/400 L. water, gave the best results in controlling the root rot disease.

Citrus (*Citrus* sp.) is one of the most important fruit crop in the world, particularly in the tropical and subtropical regions. Citrus trees are liable to be attacked by many pathogens. Citrus gummosis is considered one of the most important fungal diseases causing considerable yield losses.

The two fungal species; ***Phytophthora citrophthora*** and ***P. parasitica*** are responsible for the gummosis disease in citrus. The symptoms of gummosis disease appear as leathery and pliable wood including the cambium. The formation of gum was usually accompanied by large area of dead bark of light gray to blackish-gray discoloration. In the sever infection, large black areas of dead bark covered the blackened dead wood. Infected trees show a week growth with yellow leaves and dead twigs. Recommended treatments against gummosis were painting or foliar application. A trial to control the disease in citrus orchard by using the Fosphite was undertaken.

MATERIALS AND METHODS

- **Location:** Sharkia governorate (the Delta).
- **Host Plant:** Citrus orchard (lemon trees).
- **Target Pests:** The fungi species; ***Phytophthora citrophthora*** and ***P. parasitica***

Procedure: Fungicide treatments for the control of gummosis disease are usually carried out for one season (from January to December) and confirmed in the second season. In this study, Fosphite was used as foliar application once, on 12th of July 2001, because of lack of Fosphite (this trial wasn't planned before).

Selected trees were 20-yr-old (lemon trees) with moderate infection (25 – 40%). Fosphite was applied by the rate of 2L/400L.water. Before the treatment, the width and the length of trunk lesions were measured and the infected areas were calculated (= Length X width) to be use as references, then the average were counted. The gum lesions were marked with waterless marker pen (pre-treatment). Reducing of the diameter of the infected area was used as indicator for the efficiency of the foliar tested fungicide (Fosphite). Twenty trees were selected for treatment with Fosphite, and divided into 4 groups every group consisted of 5 trees. Average of infected areas, every 5 trees was calculated as pre-treatment and after 45 days. About 10 trees were left untreated and divided into 2 groups used as control.

RESULTS AND DISSCUSSION

Obtained data of testing the Fosphite, as foliar spraying, against gummosis disease for only one application are summarized in table (5). Data indicate that the pre-treatment average of infected areas for the four groups were 32.4, 22.0, 25.0 and 29.8 cm^2 respectively, with an average of 27.3 . Meanwhile the average of infected areas for the two groups were 28.6 cm^2, respectively. After elapse of 45 days the average of infected areas reduced sharply in all the treated trees with Fosphite. The average of infected areas were 15.6, 11.0, 13.6 and 12.4 cm^2 respectively, with an average of 13.15. Percentages of recovery were 48.0, 50.0, 54.0 and 41.6% respectively, with an average of 48.4. Data also indicate that the average of infected areas after elapse of 45 days in the control trees reached 38.2 and 34.0, respectively.

Table (5): Effect of Fosphite fungicide on gummosis disease on Lemon trees in Egypt, year 2001

Group No	Pre – treatment	After 45 days	%
	Ave. of infected areas cm^2	Ave. of infected areas cm^2	Efficacy
1	32.4	15.6	48.0%
2	22.0	11.0	50.0%
3	25.0	13.6	54.0%
4	29.8	12.4	41.6%
Control			% Increasing
1	28.8	38.2	132.6%
2	28.6	34.0	118.88%

Conclusion:

Unexpected results obtained from the trial indicated that the Fosphite fungicide can be used to control the gummosis disease. It reduced significantly the infected area on lemon tress. These results were obtained from only one spray, however, if the trees were treated with the Fosphite for 2-3 times/year, the expected results would be much greater. Further studies are still requested in this respect.

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