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INTEGRATED DISEASE MANAGEMENT FOR DRACAENA LEAF SPOT DISEASE

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ABSTRACT: Pathogenicety test on 6 month-old dracaena plants at Giza, Egypt proved that *Fusarium moniliforme* was the most virulent fungus resulting 30.41% leaf spot severity, followed by *Alternaria alternata* and *Stemphylium botryosum* which gave 11.32 and 9.45 % disease severity, respectively. Bio Arc at the concentration (3.5 g / l) was the best treatment for decreasing the linear growth of all tested fungi. The Thyme extract at the concentration (75%) was the best treatment for decreasing the linear growth of all tested fungi. *Fusarium moniliforme* was the most sensitive fungus while *S. botryosum* was the least sensitive ones.

Topsin M 70 proved to be the most effective fungicide against *F. moniliforme* followed by *S. botryosum* and *A. alternata* since it induced the highest decrease in the linear growth of all tested fungi, whereas Kocide 2000 was the least effective ones.

Topsin M 70 (at the rate 3 g / l) separately gave the best control for dracaena leaf spot under greenhouse conditions (11.9 % disease severity), while spraying with Thyme extract at the concentration of 50 % was the best alternative treatment for this purpose (14.17 % disease severity) as comparing with control treatment (17.06 % disease severity) followed by Salicylic acid at the rate 1.5 g /l and biocide at the rate 2.5 g / l.

There are no significant differences between the application of Thyme extract (at the rate 50 %) + half the recommended dose of Topsin M 70 and the application of Topsin M 70 alone (12.34 and 11.9 % diseases severity, respectively). The obtained results suggested that some natural materials such as Thyme extract can be use as a method to minimize fungicidal doses against fungal diseases.

Key words: Dracaena leaf spot, *Fusarium moniliforme*, *Alternaria alternata*, *Stemphylium botryosum*, integrated disease manegment, Thyme extract and Topsin M 70.

INTRODUCTION

Dracaenas are the most commonly members of the Family *Asparagaceae*. Most are native to the tropical regions of Africa and Asia. They use as popular ornamental indoor plants. There are very little information concerning dracaena diseases in Egypt , but **Wagih *et al.* (1989)**, **Mahmoud (1992)** reported that fungal leaf spot was the most common disease of dracaena. *Fusarium moniliforme* is one of the most serious pathogenic fungi on dracaenas. It was found to be responsible for leaf spot, stem rot and cutting rot. Also, **Hilal *et al.* (2000)** confirmed that *Fusarium moniliforme, Alternaria alternata, Stemphylium botryosum, Cladosporium dracaenatum* and *Nigrospora* sp. were the causal pathogens of *Dracaena marginata* leaf spots in Alexandria, Egypt.

Poole *et al.* (1991) found that Fusarial leaf spot symptoms on dracaena occur initially on the newest leaves of the plant which are within the central whorl. Infection only occurs when this whorl is very wet and spores are present. Lesions are irregularly shaped, tan to reddish brown and many times have a yellowish brown border. Under conditions of high disease pressure and continually wet foliage, the lesions coalesce and infection spreads into the plant meristem.

Chase and Mellich (1992) reported that Fusarium leaf spot of the red-edge dracaena (*D. marginata*) is caused by *F. moniliforme* and observed advancing from the apex until the whole leaf surface. **Sobek and Munkvold (1999)** indicated that wounding is an important factor contributing to *Fusarium moniliforme* infection. **Mohamed, Naglaa (2005)** indicated that isolation trails from leaf spots of 9 foliage plants including dracaena yielded 12 fungal genera.

However, *Coryenespora cassiicola, Alternaria alternata* and *F. moniliforme* were the most dominating fungi in isolation, followed by

Stemphylium botryosum. **Bobev *et al.* (2008)** observed severe leaf spot damage on numerous indoor potted *D. marginata* plants in Plovdiv, Bulgaria. The pathogen was identified as *F. moniliforme.*

Several control measures (biocides, plant extracts, compost tea, elicitors and fungicides) were applied either *in vitro* or *in vivo* conditions by many researchers for management of leaf spot diseases.

As for biocides application, **Michereff *et al.* (1994)** used *Bacillus megaterium* as epiphytic bacteria for controlling Curvularia leaf spot of yam plants. Also, **Collins and Jacobsen , (2003)** used *Bacillus subtilis* as a bioagent for controlling sugar beet Cercospora leaf spot. As for plant extract application, **Paster *et al.* (1995)** stated that thyme essential oil applied as fumigants protected stored grains against fungal attacking. **Baiuomy (1997)** found that thyme extract at the concentration 75% gave a complete inhibition against fungal growth of *F. moniliforme* and *R. solani.* **Amadioha (2003)** found that extracts prepared from *Digitalis lantana, Origanum majorana* and *Plantago lanceolata* gave the best results against *Colletotrichum lindemuthia*num on cowpea leaves. Also, **Shafie, Radwa (2004)** found that watery extracts of thyme and rue gave high antifungal effect against growth of *M. phaseolina, F. oxysporum* and *Sclerotium rolfisii.*

As for compost tea application , **Bates (2005)** found that poplar bark compost tea protected tomato plants from Septoria leaf spot infection. **Mikhail *et al.* (2005)** utilized composted rice straw against *Fusarium oxysporum* on cotton seedlings. Also, **Haggag and Saber (2007)** indicated that the incidence of Alternaria blight was obviously reduced in tomato and onion plants which sprayed with non-aerated compost tea (made from plant residues) compared to those non-sprayed or those sprayed with aerated compost tea.

As for elicitors application, **Chaoying and Hsiangen (1998)** indicated that Salicylic acid application on leaves of *Lilium* was effective in inducing disease resistance against *Botrytis elliptica.* **Hilal *et al.* (2006)** performed that Salicylic acid was effective against *S. sclerotiorum* on Caraway,

Coriander and Fennel seedlings. **Mahmoud *et al.* (2006)** indicated that Salicylic acid at 4 Mm gave the highest effect against Peanut diseases in Egypt. Also, **Shiping *et al.* (2006)** treated Pear cladode (*Pyrus pyrifolia*) spotted with *Alternaria alternata* by some elicitors, such as Salicylic acid and oxalic acid. The results indicated that the elicitors could significantly enhance defense-related enzyme activities, such as β-1,3-glucanase, phenylalanine ammonia lyase, peroxidase, and polyphenol oxidase activity.

As for fungicidal treatment, **Wahid *et al.* (1995)** reported that thiophanate-methyl (as Topsin M at 50 ppm) caused 100 % inhibition of Fusarial growth *in vitro*. **Tasleem *et al.* (2000)** found that Topsin M as rice seed dressing gave better control to *F. moniliforme* than Dorsal or Kasuran. **Wolf (2008)** found that Topsin M can be a very effective part of grape leaf spot management program in Northern Virginia. **Ammar *et al.* (2004)** revealed that Topsin M 70, Bellis and Tecto were the best treatments against pear cactus cladode rot caused in Egypt by *Alternaria alternata* and *Fusarium solani*. **Batta (2003)** indicated that difenoconazole (Score) at the rate of 0.20 % (W/V) significantly reduced the lesion diameter of *A. alternata* on treated fruits of *Loquat*. Also, **Wilson and Williamson (2008)**demonstrated that Topsin M suppresses *Fusarium* sp. on cotton plants at Virginia , USA .

Finally, in regard to integrated methods application, **Korsten *et al.* (1997)** found that preharvest application of *Bacillus subtilis* field sprays integrated with copper oxychloride or benomyl consistently reduced severity of avocado black spot caused by *Pseudocercospora purpurea* at Omega, South Africa. **Mora and Earle (2001)** reported that combination of *Trichoderma harzianum* and the fungicide, Bayleton was effective against *Alternaria brassicicla* on broccoli plants. Also, **Zaky, Wafaa *et al.* (2008)** found that (Rizobactrein + Salicylic acid) or (Rizobactrein + Salicylic acid + yeast) prevented the appearance of Fusarium disease symptoms of carnation for two months. The present investigation was carried out to study the integrated management for Dracaena leaf spot disease under Egypt conditions.

MATERIALS AND METHODS

Source of fungal isolates :

Pure isolates of Dracaena leaf spot pathogenic fungi, i.e. *Alternaria alternata*, *Fusarium moniliforme*, *Stemphylium botryosum* obtained from Fungal Research and Plant Disease Survey Department, Pl. Path. Res. Inst., Agric. Res. Center, Giza, Egypt were cultured on PDA plates 2 weeks at 26 ±1°C. The surface of these cultures was gently brushed in the presence of sterile distilled water (10 ml / plate), then filtered through muslin. The concentration of the fungal propagule suspensions (spores or mycelial fragments of the sterile fungus) was estimated using a haemocytometer and adjusted to 5×10^5 fungal units /ml water. Tween 20(cao.02 % v/v) was added as a wetting agent.

Pathogenicity test:

Healthy *Dracaena marginata* plants (6 monthes old) grown in 15 cm dam. plastic pots (1 plant / pot) were artificially inoculated with the previously prepared fungal suspensions. Leaves were gently scratched with carborundum to remove the thin waxed layer and then sprayed with the fungal suspensions using a hand atomizer. The inoculated plants (4 pots for each fungus) were covered with transparent plastic bags for 48 hrs to maintain high relative humidity, and then kept under observation in open air under greenhouse conditions. Uninoculated plants in 4 pots were sprayed with sterile water and placed under the same conditions as a control treatment. Symptoms of leaf spot infection were recorded and reisolation from the full developed lesions was carried out to support the pathogenicity of each fungus.

Disease severity percentage was estimated as the ratio of spotted area to whole leaf surface with applying the following formula according to **Horsfall and Barratt (1945):**

$$\text{Disease severity (\%)} = \frac{\text{Sum (No. of each infection category} \times \text{Numerical value of infection category)}}{\text{Total number of leaves} \times \text{the highest numerical value of infection category}} \times 100$$

Where the categories were 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 equal to 1-5 ,6-10,11-15, 16-20, 21-25, 26-30, 31-35, 36-40, 41-45 and 46-50% of leaf surface

showing leaf spot, respectively, as well as zero type category showing no infection.

Disease management:

a - Under laboratory conditions :

The disease management was investigated by using some biocides, plant extracts, compost filtrate and fungicides. They were tested firstly in the laboratory towards growth of the pathogenic fungal isolates.

1. Effect of some biocides :

Efficacy of two biocides namely, Bio Arc (*Bacillus megaterium*, 25×10^6 cfu /g) and Bio Zeid (*Trichoderma album*, 1×10^7 cfu / g) both used at the rate of 2.5 g / l water obtained from Biofungicides Unit, Pl. Pathol. Res. Inst., ARC, Giza, Egypt was evaluated on linear growth of the pathogenic fungi on PDA medium. Three different concentrations (1.5, 2.5 and 3.5 g / l) were prepared. The appropriate amount of each biocide was mixed with the medium in each flask just before solidification. Ten ml of each biocide-amended medium was poured in each Petri dish. Four plates of each particular treatment were inoculated with 5mm discs of fungal growth and incubated at 20°C. The fungal growth was measured when radial growth in any control plate reached its maximum (9 cm).

2. Effect of some plant extracts :

Antifungal activity of the hot water leaf extract of the three aromatic plants, i.e. Marjoram (*Majorana hortensis*), Thyme (*Thymus vulgaris*) and Eucalyptus (*Eucalyptus rostrata*) against growth of the pathogenic fungi was investigated. The extracts were prepared according to the method used by **Agha (1992)**. The fresh herbs were washed thoroughly in tap water and left at room temperature in order to be dried. Seventy grams of each test plant were finely grounded and separately boiled in 500 ml distilled water for 2 hrs, then left to cool and blended for 5 min. The extracts were filtrated through double cheesecloth, then through Whatman No. (1) Filter paper. The filtrates were adjusted with distilled water to 100 ml, centrifuged at 5000 rpm for 30 min and sterilized by center glass G5. The original extract

was considered as 100 % conc. and it was diluted with sterile distilled water to obtain the three concs. (25, 50 and 75 %). Each extract concentration was separately mixed with sterilized PDA medium just before solidification (1:9 v/v), then poured in sterilized Petri dishes. Medium free from plant extract provided with the same volume of the sterile distilled water was used as a control. Four plates of each particular treatment were inoculated at the center with fungal disks (5-mm-diam) cut from 7 days old culture of each test fungus, then incubated at 26 ± 2 °C. The linear growth diameter of each test fungus was determined when the mycelial growth filled any control plate. Reduction of mycelial growth was calculated as fungal growth inhibition percentage relative to fungal growth of the control treatment as follows:

$$\text{Reduction \%} = \frac{\text{Control} - \text{treatment}}{\text{Control}} \times 100$$

3. Effect of some fungicides:

Three fungicides, Topsin M 70 %, Score 25 % and Kocide 2000 were prepared to test *in vitro* against growth of the pathogenic fungi. Trade name, chemical name, formulation and manufactures of these fungicides are presented in Table (1).

Table (1) Trade, common and chemical names of the fungicides tested with reference to their type of formulation and manufactures.

Trade name	formulation	Common name	Chemical name	Manufacture
Kocide 2000	WP	Cu-hydroxide	Copperhydroxide ($Cu(OH)_2$)	Sentic
Score 25% EC	EC	Difenoconazole	Cis, trans 3-chloro-4-[4-methyl-2-(1 *H* -1,2,4-triazol-1-ylmethyl)-1,3-dioxolan-2-yl]phenyl 4-chlorophenyl ether	Syngenta
Topsin-M 70%	WP	Thiophenate methyl	1,2- (3-methoxycarbonyl -2-thiouredio) benzene (TPM)	Nippon Soda Co., Japan

The fungicides were used at the recommended doses, i.e. 1.8 g / l of Kocide 2000, 1 ml / l of Score and 3 g / l of Topsin M. Medium free from fungicides provided with the same volume of the sterile distilled water was used as a control. Each plate was inoculated at the center with fungal discs

(5-mm-diam) cut from 7 days old culture of each test fungus, then incubated at 26 °C ± 2. Four plates of each treatment were used as replicates. The linear growth diameter of each test fungus was determined when the mycelial growth filled any control plate. Reduction of mycelial growth was calculated as percentage of the treated fungal growth relative to the untreated fungal growth as follows:

$$\text{Reduction \%} = \frac{\text{Control} - \text{treatment}}{\text{Control}} \times 100$$

b. Under greenhouse conditions:

Two experiments were conducted by spraying different materials (separate application or integrate application) for controlling of Dracaena leaf spot disease under greenhouse conditions of Pl. Dis. Res. Dept., Pl. Pathol. Res. Inst., Agric. Res. Center at Giza during the two successive seasons (2008- 2009).

1- Separate application:

Healthy red-edge dracaena plants (*D. marginata*) (6 monthes old) grown in 15 cm dam. plastic pots (1 plant / pot) were artificially inoculated with the previously prepared fungal suspensions as shown in pathogenicity test. The most laboratory effective treatments beside pelargonium compost tea and Salicylic acid (Table 2) were separately sprayed on 10 dracaena plants for each treatment under greenhouse conditions. Untreated plants were sprayed with distilled water as control.

Table (2): The concentration of the different materials used separately under greenhouse conditions for controlling the test pathogenic fungi:

Treatment	Concentration
Bio Arc	2.5 g / l
Thyme	50 %
Compost filtrate	75 %
Salicylic acid	1.5 g /l
Topsin M 70 %	3 g / l

Pelargonium compost as a phenolic compound source was prepared as follows: Fresh compost (directly after delivery) was watery extracted by soaking 100 g of the compost in 100 ml of distilled water for 24 h at the room temperature and then filtered through filter paper Whatman No (1).The filtrates were adjusted with distilled water to 100 ml, centrifuged at 5000 rpm for 30 min and sterilized by center glass G5. The original extract was considered as 100 % conc. and it was diluted with sterile distilled water to obtain the concentration 75 %.

2- Integrate application:

Another parallel experiment was carried out by using the combination of half the fungicidal recommended dose of the more effective tested fungicide (1.5 g / l, Topsin M 70 %) and each one of the previously tested materials .All plants were covered with transparent plastic bags for 48 hrs to maintain high relative humidity. Plants were kept in greenhouse under daily observation for 21 days after inoculation. Disease severity was determined according to the equation of **Horsfall and Barratt (1945).**

EXPERMENTAL RESULTS

Pathogenicity test:

Data in table (3) indicate that *Fusarium moniliforme* proved to be the most virulent fungus resulting in 30.41% disease severity 21 days after inoculation, followed by *Alternaria alternata* and *Stemphylium botryosum* which gave 11.32 and 9.45 % disease severity, respectively.

Table (3): Disease severity percentage of *Dracaena marginata* leaf spot disease 21days after inoculation with the test pathogenic fungi.

Test fungus	Disease severity %
Alternaria alternata	11.32
Fusarium moniliforme	30.41
Stemphylium botryosum	9.45
Control (without fungus)	0.00
Mean	17.06

L.S.D. at 5% for Fungi = 0.97

Disease management:

a – Under laboratory conditions:

1. Effect of some biocides:

Data in Table (4) demonstrate that using two biocides tested in PDA plates significantly increased mean percentage of reduction in mycelial growth of all fungi relative to control (without biocides). In this respect, Bio Arc proved to be the most effective biocide since it significantly figured mean percentage of reduction in mycelial growth by 52.63% compared with using Bio Zeid (46.96%). Positive relationship was realized between biocide activity and increasing of biocide concentration (from 1.5 to 3.5 g/L) in PDA plates.

Table (4): Effect of biocide concentrations on linear growth reduction (%) of the pathogenic fungi under laboratory conditions.

Fungus	Conc. (%)	Linear growth (cm)		Mean	Reduction (%)		Mean
		Bio Arc	Bio Zeid		Bio Arc	Bio Zeid	
Alternaria	1.5	3.8	4.0	3.9	56.6	55.5	56.2
	2.5	2.5	2.9	2.7	70.0	67.7	70.0
alternata	3.5	1.8	2.0	1.9	79.1	77,7	78.4
	Mean	2.7	2.9	4.3	52.0	50.5	51.1
Fusarium	1.5	3.6	5.0	4.3	59.7	44.1	51.9
	2.5	2.0	3.3	2.6	77.7	63.0	70.4
moniliforme	3.5	1.7	2.3	2.0	80.2	73.6	76.9
	Mean	2.4	3.5	4.5	54.4	45.2	49.8
Stemphylium	1.5	4.0	4.2	4.1	55.5	52.7	54.1
	2.5	2.5	4.0	3.2	72.2	55.5	63.8
Botryusum	3.5	2.0	2.5	2.2	77.7	72.2	75.0
	Mean	2.8	3.6	4.6	51.3	45.1	48.2
Mean		4.26	4.7		52.6	46.9	

L.S.D. at 5% for:
Fungus (F) = 0.3 , Biocide (B) = 0.2 , Conc.(C) = 0.3 ,
F×B = 0.4, F×C= 0.6, B ×C = 0.5, F×C×B = 0.9

In this regard, the highest concentration was the most effective against *A. alternata* since its linear growth recorded (78.4 mm decrease) comparing with the control treatment. *Fusarium moniliforme* was the most tolerant ones to the tested biocides. In general, Bio Arc at the highest concentration was the best treatment for inducing of linear growth decrease of all tested fungi.

2- Effect of some plant extracts:

The results in Table (5) reveal that the Thyme extract at the highest concentration (75%) was the best treatment for inducing the highest decrease in the linear growth of all tested fungi. *Fusarium moniliforme* was the most sensitive fungus (62.5 %) under 75 % of Thyme extract.

Table (5): Effect of concentration of plant extracts on linear growth reduction (%) of the pathogenic fungi under laboratory conditions.

Fungus	Conc. (%)	Linear growth (cm)			Mean	Reduction (%)			Mean
		Thyme	Eucalyptus	Marjoram		Thyme	Eucalyptus	Marjoram	
Alternaria alternata	25%	5.3	6.2	6.8	6.1	40.3	30.5	23.6	31.4
	50%	5.1	5.6	6.3	5. 7	43.6	37.5	29.1	36. 7
	75%	4.1	4.5	3.8	4.1	54.1	50.0	56.9	53.7
	Mean	5.9	6.3	6.5	6.2	34.5	29.5	27.4	30.4
Fusarium moniliforme	25%	5.0	5.8	6.2	5.7	44.4	34.7	30.5	36.5
	50%	4.0	4.8	5.8	4.9	55.5	45.8	34.7	45.3
	75%	3.3	4.2	5.0	4.2	62.5	52.7	44.4	53.2
	Mean	5.3	6.0	6.5	5.9	40.6	33.3	27.4	33.7
Stemphylium botryosum	25%	6.7	6.5	7.0	6.7	25.0	27.7	22.2	25.0
	50%	6.0	5.8	6.0	5.9	33.3	35.0	33.3	33.8
	75%	4.7	5.0	4.5	4.7	47.2	44.4	50.0	47.2
	Mean	6.6	6.5	6.6	6.6	26.3	26.8	26.3	26.5
Mean		5.9	6.3	6.5	-	33.8	29.8	27.0	-

L.S.D.at 5% for: F =0.3, T= 0.3, C= 0.3, F×T =0.5, F×C= 0.6, T×C=0.6, F×C×T =1.0

On the contrary, *S. botryosum* was the least sensitive ones (22.2 %) under 25 % of marjoram extract.

3 – Effect of some fungicides:

Data in Table (6) indicate that Topsin M 70 proved to be the most effective fungicide particularly against *F. moniliforme* followed by *S. botryosum* and *A. alternata* since it induced the highest decrease in the linear growth of all tested fungi, whereas Kocide 2000 was the least effective ones.

Table (6): **Effect of three fungicides on linear growth reduction (%) of the pathogenic fungi under laboratory conditions.**

Fungus	Linear growth (cm)			Mean	Reduction (%)			Mean
	Kocide 2000	Score 25% EC	Topsin M70		Kocide 2000	Score 25% EC	Topsin M70	
Alternaria alternata	6.4	6.0	4.9	5.8	28.9	33.3	45.6	35.9
Fusarium moniliforme	5.6	4.7	3.5	4.9	37.8	47.8	61.1	48.9
Stemphylium botryosum	6.3	5.8	4.6	5.6	30.0	35.0	48.9	38.2
Mean	5.9	5.5	4.3	-	32.3	38.9	51.9	-

L.S.D. at 5% for Fungus (F) = 0.2, Treatment (T) =0.3, T×F=1.8

b – Under greenhouse conditions:

1- - Separate application:

Data in Table (7) indicate that Topsin M 70 (at the rate 3 g / l) separately gave the best results for controlling dracaena leaf spot under

greenhouse conditions (11.9 % disease severity). Thyme extract at the rate 50 % was the best alternative treatment for this purpose (14.17 % disease severity) followed by Salicylic acid at the rate 1.5 g /l and biocide at the rate 2.5 g / l (14.83 and 14.83 % , respectively) as comparing with control treatment (17.06 % disease severity).

Table (7): Effect of four alternative material spraying beside the fungicide, Topsin M 70 on dracaena leaf spot disease severity under greenhouse conditions.

Treatment	Disease severity (%)			
	Alternaria alternata	*Fusarium moniliforme*	*Stemphylium botryosum*	Mean
Bio Arc	9.50	28.50	7.25	15.83
Thyme	9.10	26.42	7.00	14.17
Compost filtrate	9.90	29.80	8.72	16.14
Salicylic acid	9.05	27.70	7.75	14.83
Topsin M 70 %	8.45	21.10	6.17	11.91
Control	11.30	30.42	9.44	17.06

L.S.D at 5% for:
Fungus (F) = 2.2, Treatment (T) =1.3, T×F=1.8

2- Integrate application :

Data in Table (8) indicate that their are no significant differences between the application of Thyme extract (at the rate 50 %) + half the recommended dose of Topsin M 70 and the application of Topsin M 70 alone (12.87 and 11.91 % diseases severity, respectively) .

Table (8): Effect of the integrated application of four alternative materials beside the half dose of Topsin M 70 on dracaena leaf spot disease severity under greenhouse conditions.

Treatment	Disease severity (%)			
	Alternaria alternata	*Fusarium moniliforme*	*Stemphylium botryosum*	Mean
Bio Arc+ ½ Fungicide	9.31	27.20	7.10	14.54
Thyme + ½ Fungicide	8.80	23.70	6.10	12.34
Compost + ½ Fungicide	9.72	27.30	7.81	14.94
Salicylic + ½ Fungicide	8.91	25.21	6.92	13.68
Topsin M 70 %	8.45	21.10	6.17	11.91
Control	11.30	30.42	9.44	17.06

L.S.D. at 5% for:
Fungus (F) = 2.2, Treatment (T) =1.3, T×F=1.8

The obtained results suggested that some natural materials such as thyme extract can be use as a means to minimize fungicidal doses of fungal diseases.

DISCUSSION

Dracaenas are used as valuable ornamental foliage plants. Production of these plants is faced with some problems, among the most important ones are diseases especially leaf spot particularly in warm and moist conditions where the disease can lead to heavy defoliation **(Chase, 1997).** In this study, *Fusarium moniliforme*, *Alternaria alternata* and *Stemphylium botryosum* were the most dominant fungi on *Dracaena marginata* plants in Egypt. According to the available literature, **Wagih *et al.* (1989)** reported *F. proliferatum* as an important fungal pathogen of leaf spot and stem rot of *D. sanderiana* in Alexandria, Egypt. On the other hand, **Hilal *et al.* (2000)** recorded *F. moniliforme* on *Dracaena* plants for the first time in Egypt. Also, **Mohamed, Naglaa (2005)** isolated *Coryenespora cassiicola*, *Alternaria panax* and *F. moniliforme* from leaf spots of some plants including Dracaena plants.

Bio Arc at the highest concentration (3.5 g / l) was the best treatment for inducing the highest decrease in the linear growth of all tested fungi. This result is similar to those reported by **(Collins and Jacobsen , 2003)** who recorded that the growth of *Cercospora beticola* by *B. subtilis* under *in vitro* conditions..

All the tested plant extracts, i.e. Marjoram (*Majorana hortensis*), Thyme (*Thymus vulgaris*) and Eucalyptus (*Eucalyptus rostorata*) inhibited linear growth of the tested pathogenic fungi, but the Thyme extract was the most effective particularly against *F. moniliforme*. These results are similar to those reported by **(Baiuomy, 1997 and Amadioha (2003)** who found that the extract of *Origanum majorana* gave the best results against *Colletotrichum lindemuthianum* on cowpea leaves.

Topsin M 70 proved to be the most effective fungicide *In vitro* particularly against *F. moniliforme* followed by *S. botryosum* and *A. alternata* since it induced the highest decrease in the linear growth of all

tested fungi , whereas Kocide 2000 was the least effective ones. These results are somewhat similar to those reported by **Tasleem *et al.* (2000)** ; **Ammar *et al.* (2004)** and **Sears *et al.* (2005)** who reported that Topsin M 70 was the best fungicide against growth mycelium of *Fusarium* spp. , *Alternaria alternata* and *Botryodiplodia theobromae*. Also, Spraying *Dracaena* plants separately with the fungicides under greenhouse conditions resulted in good control of the disease. Topsin-M 70 followed by Score showed the highest effectiveness while Kocide 2000 was the least effective fungicide. These results are similar to those reported by (**Chase, 1987)** who found that (thiophanate) at 12 oz a.i. /100 gal applied weekly for 6 weeks as a foliar spray gave good control of Fusarium leaf spot on *Dracaena marginata.*

Thyme extract at the rate 50 % was the best alternative treatment for this purpose followed by Salicylic acid and the biocide. The antifungal nature of thymol is caused by its ability to alter in the hyphal morphology and cause hyphal aggregates, resulting in reduced hyphal diameters and lyses of hyphal wall **(Numpaque *et al.*, 2011)**.

Their are no significant differences between the application of Thyme extract + half the recommended dose of Topsin M 70 and the application of Topsin M 70 alone. The obtained results suggested that some natural materials such as Thyme extract can be use as a means to minimize fungicidal doses against fungal diseases.

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المكافحة المتكاملة لمرض تبقع أوراق الدراسينا

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*** قسم أمراض النباتات الطبية والعطرية ، مركز البحوث الزراعية بالجيزة .*

أثبت اختبار العدوي الصناعية الذي أجري علي نباتات الدراسينا مارجيناتا عمر 6 أشهر في محطة البحوث الزراعية بالجيزة أن الفطر فيوزاريوم مونيليفورم هو أكثر الفطريات شراسة في إحداث أعراض التبقع الورقي يليه الفطر ألترناريا ألترناتا فالفطر استمفليوم بوتريوسوم.

كان المركب الحيوي بيو أرك عند تركيز 3.5 جم / لتر أفضل المركبات الحيوية المختبرة لتقليل النمو الطولي للفطريات الثلاثة المختبرة .

كان مستخلص عشب الزعتر عند التركيز 75 % أفضل المستخلصات النباتية المختبرة لتقليل النمو الطولي للفطريات الممرضة للدراسينا ، وكان الفطر فيوزاريوم أكثرها تأثراً بينما كان الفطر استمفليوم أقلها تأثراً بهذه المستخلصات.

كان المبيد الفطري توبسين م 70 أفضل المبيدات المختبرة معملياً ضد نمو الفطريات الممرضة المختبرة ، بينما كان المبيد كوسايد 2000 هو أقلها فعالية .

كان رش النباتات بمعدل 3 جم / لتر بالمبيد توبسين م 70 يعطي أفضل النتائج لمقاومة تبقع الدراسينا تحت ظروف الصوبة (11.9 % في مقابل 17.06% في معاملة المقارنة).

أدي الجمع بين نصف جرعة التوبسين الموصي بها وبين مستخلص عشب الزعتر إلي خفض شدة الإصابة بما يعادل استخدام الجرعة الكاملة دون فرق معنوي ، وهذا يشير إلي إمكانية استخدام المستخلصات النباتية الفعالة مثل مستخلص الزعتر كوسيلة لتقليل جرعات المبيدات الفطرية المستخدمة لمقاومة الأمراض النباتية الفطرية.