Zagazig J.Agric. Res., Vol . 29 No.(1) 2002 *129-150*

RESPONSE OF MAIZE PLANTS GROWN UNDER UNFAVORABLE CONDITIONS TO SOME PLANT EXTRACTS

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Received 23 / 1 / 2002 *Accepted 26 / 2 / 2002*

ABSTRACT: The air dried leaves of Lantana (*Lantana camara* L.), Eucalyptus (*Eucalyptus citriodora* L.), and tomato (*Lycopersicon esculentum* L.) plants were extracted by solvents of ethanol, chloroform and petroleum ether. These extracts were tested to some phytochemical compounds and their ability to control the stalk rot disease, as well as, study their effects on growth and some physiological characters of maize plants cv. Balady grown in soil infested by *Fusarium moniliforme* under greenhouse conditions.

Our results indicated that, the ethanolic extracts of both *Eucalyptus* and tomato contained high amounts of tannins and flavonoids, whereas these compounds were missed in *Lantana*. All ethanolic extracts of plants contained moderate amounts of alkaloids and traces of sterols. The chloroformic extracts of the used plants contained saponins, sterols, tannins, alkaloids and flavonoids. Tannins were in equal amounts in all plants. Saponins were found in higher amounts in Eucalyptus than that in other plants. Flavonoids were higher in Lantana than that in other plants. The petroleum ether extracts of all plants possessed mainly alkaloids and traces of sterols, whereas tannins and flavonoids were missed. Coumarin has been missed in all plant extracts.

Growth parameters were significantly inhibited as a result of the infection by *Fusarium moniliforme*. Length and size of roots, number

of leaves, leaf width, total leaf area, leaf area index as well as the fresh and dry weights of roots, leaves and whole plant were the most severely characters. No marked differences were noticed between the infested and healthy plants in the shoot/root ratio. The inhibition in growth was accompanied with a high infection percentage reached about 65%. Application plant extracts was not only controlled the disease (the infection percentage reached 0.0% by application the petroleum etheric extracts of Lantana and Eucalyptus), but also stimulated the growth of the infested plants over the healthy one.

The concentrations of chlorophylls a, b and total as well as carotenoids in the leaves of infested maize plants were lower than that in the healthy one. The ratio of chl.a/b was higher whereas the ratio of total chlorophylls/carotenoids was lower in the leaves of the infested plants than that in the healthy plants. Responses of the photosynthetic pigments in the infested plants to the tested plant extracts showed different trends, the chloroformic extract of Eucalyptus was the best in this respect.

In the infested plants, the leaf water content and the transpiration rate were less by about 9.3 and 20.7%, whereas the activities of both peroxidase and phenoloxidase were higher by about three and two fold, respectively, if compared with the healthy plants. Generally, application of most plant extracts increased the water content, transpiration rate and the activity of enzymes in the infested plants.

Key words: *Maize plant, plant extracts, stalk rot disease, growth, photosynthetic pigments, water content, transpiration rate, peroxidase, phenoloxidase.*

INTRODUCTION

Corn (*Zea mays* L.) is one of the most important nutritional crops. In Egypt, its importance has been increased for adding its flower to wheat in producing human bread. This crop is subjected to attack by many diseases under Egyptian conditions. Therefore, many pesticides (fungicides, insecticides, bactericides, etc.) were used to protect it. Due to the massive application of such pesticides, the importance of pesticide resistance in pests and pathogens as well as the problems of upsetting of natural balance and hazards for man and animals has increased enormously. Therefore, searching for alternative and safety ways for pest and diseases control not involving

pesticides is become necessary. One of these ways is the application of naturally occurring substances against pathogens caused diseases.

In recent years, studies have been done to evaluate the fractionation of various edible plant extracts yielded products possessing fungicidal properties. Hernandez-Anguiano *et al.* (1998) found that, the vegetal powders of plants: *Gliricidia sepium, Guazuma tomentosa, Gnaphalium inoratatum, Melia azedarach, Neurolaena lobata* and others inhibited the development of *Aspergillus* sp. and *Fusarium* spp. and showed interspecific antagonism. Irobi and Daramola (1993) separated the extracts of *Mitracarpus villosus* (Rubiaceae) leaves and found that, ethanolic extracts produced definite antifungal activities against *Trichopyton rubrum, Microsporum gypseum, Condida albicans, Aspergillus niger and Fusarium solani*. Adeleye and Ikotun (1989) reported that, bulbuls and tubers of a wild variety of yam (*Dioscorea bulbifera*) contained the alkaloid, dihydrodioscorine. When crystallized in its hydrochloride form and incorporated in potato dextrose agar at a final concentration of 0.1%, it reduced the rate of growth of 5 plant pathogenic fungi. Furgal-Wegrazycka (1984) reported that, when plant extracts of 39 lines resistant to some races of *Fusarium solani* and *Pythium ultimum* were added to the medium in which isolates of these pathogens were being cultured, both the growth of mycelium and its sporulation were inhibited. Growth was checked more strongly in cultures of *Fusarium oxysporum* races than in the other organisms. Extracts from susceptible lines produced no such effects.

On the other side, studies on the effect of plant extracts on the growth and physiology of plants are incompletely and rarely. Ragab (1997) reported that, plant juice of black nightshade, dwarf nettle, *Lantana camara*, onion, garlic and cabbage increased the growth characters of pea plants infected with the different pathogens under greenhouse conditions. Herger and Klingauf (1990) reported that, treatment with aqueous and ethanolic extracts of fresh or dried leaf material of *Reynoutria sachalinensis* (Polygonaceae) controlled the powdery mildew fungi on apples, Begonia, cucumbers and grapes. The host plants exhibited delayed senescence and increased in chlorophyll contents, ethylene production and various enzyme

activities. Gaafar *et al.* (1989) tested some plant extracts and found that, garlic extract was the most effective in controlling damping-off and root-rot fungi attacking tomato plant and its applying led to a significant increase in root and stem lengths as well as the fresh and dry weights.

Accordingly, this study aimed to through light on the effect of some plant extracts on the growth, some physiological and biochemical aspects of maize plants grown in infested soil with Fusarium, as well as its role in minimizing the percentage of infection.

MATERIALS AND METHODS

Pot experiments were carried out in a greenhouse at the Experimental Farm of the Faculty of Agriculture, Shibin El-Kom, Minoufiya University to study the effect of allelochemics present in extracts of some plants on maize plants grown in polluted soil with *Fusarium moniliforme*. Sowing was carried out in pots with 25-cm inner diameter, on Mai 1998 and 1999 using maize grains cv. Balady, obtained from the Agronomy Dept., Faculty of Agriculture, Minoufiya University. Each experiment was designed to include eleven treatments: three extracts of *Lantana camara* L., three extracts of *Eucalyptus citriodora* L., three extracts of *Lycopersicon esculentum* L., and two controls without extracts (1st healthy and 2nd infested).

Plant extracts: The foliage of *Lantana camara* L, *Eucalyptus citriodora* L., and *Lycopersicon esculentum* L. plants were completely air-dried, then ground to fine powders in a grinder. A known weight of each plant were successively extracted with petroleum ether (b.p. 60-80°C), chloroform and ethanol/water (3:1 v/v) based on methods described by Meisner *et al.* (1970) and Freedman *et al.* (1979). The crude gum of each solvent was weighted and redissolved in owning solvent to give conc. 5%. The obtained extracts were subjected to the following tests:

-Test for tannins (Shellard, 1957)
-Test for flavonoids (Geissan, 1962)
-Test for saponins (Farsworth, 1966)
-Test for sterols and/or triterpens (Liberman and Barchard, 1980)
-Test for alkaloids and/or nitrogenous bases (Remo, 1960)
-Test for coumarin (Feigal, 1960).

Preparation of Fugal inocula and Soil infestation: For preparation the fungal inocula for pathogenicity tests, sorghum grains were washed, filled in one liter

bottles at the rate of 250 gm/l then moisted with a suitable amount of distilled water, then autoclaved at 1.5 kg/cm^2 for 30 min. and inoculated with each isolate individually, then incubated at 27°C for 15 days. Pots were filled with unsterilized soil then mixed thoroughly with the growing fungus (*Fusarium moniliforme* Sheldon mixture of 4 isolates (M30, M33, M37 and M39) at the rate of 3% w/w and watered. The infested soil in pots was sown with Balady var. after 7 days.

Treatments and agricultural practices: Forty maize grains var. Balady were soaked in each extract (prepared before) for one hour as a seed dresser and stayed to dry for three hrs before sowing and the residue extract was added to the 4 pots of the same treatment after sowing. Ten treated seeds of each extract were sowed in each pot. Four pots were sowed by grains without extracts in infested soil and another 4 pots were sowed by untreated grains in non infested soil to serve as a control 1 and 2. Pots were arranged in a complete randomized block design. All pots were received calcium supperphosphate (15.5% P_2O_5) at rate of 1.6 g P_2O_5/pot before planting, N and K were also added in two doses through the growth period in the form of ammonium nitrate (33% N) and potassium sulphate (48% K_2O) at rates of 1.36 g N/pot and 0.81 g K_2O/pot, respectively. Pots were irrigated with tap water whenever to keep the moisture in soil at about 65% of the total water holding capacity of the soil during the experimental period.

Measurement of infection percentage: After 60-85 days from sowing the percentage of infection with stalk rot disease were recorded (Infection (%) = {(No. of infested plants/Total No. of plants)*100}

Samples and measurements of growth and physiological characters: After eighty days from sowing, a random sample of five plants was carefully taken from each treatment and the following measurements were done:

-Vegetative growth characters: Stem length (cm), root length (cm) and size (cm^3), leaf length and its maximum width (cm), number of leaves per plant, fresh and dry weights of root, stem and leaves (g/plant), dried at 70°C for 72 hrs in an electric oven, then the shoot/root ratio was calculated, total leaf area (cm^2/plant) using the disk method according to Bremner and Taha (1966) and leaf area index (LAI= total leaf area, cm^2/area of pot surface, cm^2).

-Photosynthetic pigments were extracted from fresh leaves using

acetone 80% and estimated according to Wettestein (1957), then calculated as mg/g dry weight.

-Leaf water relations: Total water content (TWC, %), and transpiration rate (mg/ cm^2. h) were measured according to Kreeb (1990).

-Activity of some enzymes: Phenoloxidase and peroxidase activities were determined in fresh leaves according to Broesh (1954) and Fehrman and Dimond (1967).

Statistical analysis: Data obtained were statistically analyzed and the L.S.D. test at 5% level of probability was used to compare the means of the treatments (Gomez and Gomez, 1984) with help the COSTAT C Statistical package (American Computer Program).

RESULTS AND DISCUSSION

Phytochemical compounds in plant extracts:

Data given in Table (1) reveal the results of tests for screening the phytochemical compounds in extracts of *Lantana*, *Eucalyptus* and tomato plants with different solvents. The tests of ethanolic extracts showed that *Lantana camara* contained only saponins, sterols and alkaloids, whereas *Eucalyptus* extract contained tannins, sterols, alkaloids and flavonoids, and tomato extract contained saponins, sterols, alkaloids and flavonoids. The ethanolic extracts of both *Eucalyptus* and tomato contained high amounts of tannins and flavonoids, whereas these compounds were missed in *Lantana*. All plants contained moderate amounts of alkaloids and little amounts of sterols.

Data in the same Table show that the chloroformic extracts of the used plants contained saponins, sterols, tannins, alkaloids and flavonoids. Tannins were found in equal amount in all plants. Saponins were found in higher amounts in *Eucalyptus* than that in other plants. Flavonoids were higher in *Lantana* than that in other plants.

The petroleum etheric extracts of all plants possessed mainly alkaloids and traces of sterols, whereas tannins and flavonoids were missing. Both of *Eucalyptus* and tomato extracts contained traces of saponins, meanwhile *Lantana* extract did not contain it.

It is evident from the phytochemical tests that, coumarin has been missed in all plant extracts by all solvents. In this respect, Elliger *et al.* (1981) isolated and identified several compounds from tomato leaves (*Lycopersicon*

Table (1): Phytochemical screening in some plants extracted by different solvents

Plants / Solvents / Tests	Lantana camara			Eucalyptus sp.			Tomato		
	Ethanol	Chlorof.	Pet.Ether	Ethanol	Chlorof.	Pet.Ether	Ethanol	Chlorof.	Pet.Ether
Saponins	+	+	-	-	+++	+	+	++	+
Tannins	-	+++	-	+++	+++	-	+++	+++	-
Sterols	+	+	+	+	+	+	++	+	++
Alkaloids	++	++	++	++	++	++	++	++	++
Flavonoids	-	+++	-	+++	+	-	++	+	-
Coumarin	-	-	-	-	-	-	-	-	-

- = Not detected
+ = Traces
++ = Medium content
+++= High content

esculentum). The major allelochemics were α–tomatine, chlorogenic acid, rutin and a new caffeyl derivative of an aldaric acid. Waiss *et al.* (1981) isolated several diverse of organic compounds from corn, cotton, tomato, sunflower and soybean plants. These compounds included flavonoids, tannin, terpenoids, cyclopropenoid acids and cyclitols. El-Kishin *et al.* (1982) extracted the dry powder of leaves of *Lantana camara*, the solvent was removed and the residue chromatographed on a silica gel column. The active fractions were those eluted with petroleum ether and 1:1 petroleum ether-diethylether. Fraction No.1 was tested for the presence of glucosides, carbohydrates and alkaloids with negative results. However, they gave positive results with tests for sterols and/or triterpenoids.

Vegetative growth characters:

Data illustrated in Table (2) show that, all vegetative growth parameters were significantly inhibited as a result of the infection with *Fusarium moniliforme*. The stem length, length and size of root, number of leaves, length and width of leaf, total leaf area and leaf area index of the infected plants were reduced by about 6.5%, 53.9%, 33.3%, 22.2%, 8.3%, 30.8%, 60.2%, and 60.3%, respectively if compared with the healthy plants. Also, the fresh and dry weights of roots, stem, leaves and whole plant were significantly reduced in the infested maize plants compared with the healthy one (Table, 3). These reductions in fresh and dry weights were about 74.6 and 63.6% for roots, 2.3 and 8.3% for stem, 51.4 and 60.2% for leaves and 41.7 and 54.3% for whole plant, respectively. Regarding to the Shoot/Root ratio (S/R), it can be revealed that, no marked differences between the infested and healthy plants in the S/R ratios were noticed. The obtained results are in agreement partly with those mentioned by Ragab (1997) on pea plants and Gaafar *et al.* (1989) on tomato plants. The inhibitory effect of the infection by *Fusarium moniliforme* on growth of maize plants might be attributed to ability of causal fungi to penetrate the host tissues leading to an occurrence infection the symptoms of diseases due to its secretor some toxic substances causing the most serious damage of maize plants.

Responses the growth of the infested plants to treatments with extracts of *Lantana camara*, *Eucalyptus* and tomato plants by ethanol, chloroform and petr.-ether differed from character to another.

Table(2): Effect of some plant extracts on some growth characters of maize plants grown in soil infected with *Fusarium moniliforme* under greenhouse conditions after 80 days from sowing.

Characters / Treatments "Plant extracts at 5%"	Stem length (cm)	Root length (cm)	Root size (cm^3)	No. of leaves/ plant	Leaf length (cm)	Leaf width (cm)	Leaf area (cm^2/plant)	Leaf area index
Ethanol-Lantana	88.00	17.50	10.00	7.00	59.00	6.00	4018.22	3.20
Chloroform-Lantana	95.00	13.50	10.00	8.00	60.00	5.70	3992.99	3.17
Pet.Ether-Lantana	98.50	23.00	40.00	10.00	67.00	8.00	6721.46	5.35
Ethanol-Eucalyptus	89.50	35.00	15.00	9.00	39.00	7.70	1766.25	1.41
Chloroform-Eucalyptus	38.00	10.00	10.00	7.00	50.00	4.20	1333.52	1.06
Pet.Ether-Eucalyptus	88.50	20.50	15.00	11.00	55.00	6.80	3770.94	3.00
Ethanol-Tomato	56.50	21.00	8.00	6.00	44.00	3.00	3002.63	2.39
Chloroform-Tomato	74.00	27.00	25.00	8.00	56.00	4.50	2110.67	1.68
Pet.Ether-Tomato	80.50	21.00	18.00	8.00	41.00	6.50	609.39	1.89
Control (inf. Plants)	53.00	9.00	6.00	7.00	44.00	1.80	706.50	0.56
Control (heal. Plants)	56.70	19.50	8.00	9.00	48.00	2.60	1775.08	1.41
L.S.D. at 5%	5.232	3.581	4.67	2.35	4.391	1.53	2.359	2.89

Table(3): Effect of some plant extracts on fresh and dry weights as well as shoot/root ratio of maize plants grown in soil infected with *Fusarium moniliforme* under greenhouse conditions after 80 days from sowing.

Characters / Treatments "Plant extracts at 5%"	Fresh Weight (g/plant)				Dry weight (g/plant)				Shoot/Root ratio
	Root	Stem	Leaves	Whole plant	Root	Stem	leaves	Whole plant	
Ethanol-Lantana	7.00	37.90	21.70	66.60	2.25	4.99	4.55	11.79	4.21
Chloroform-Lantana	3.90	37.90	23.30	65.10	1.05	4.65	4.51	10.21	3.27
Pet.Ether-Lantana	33.50	80.00	38.00	151.50	7.40	7.91	6.61	22.9	2.10
Ethanol-Eucalyptus	7.90	28.20	17.00	53.10	1.81	3.21	2.00	7.02	2.88
Chloroform-Eucalyptus	8.70	15.00	9.50	33.20	2.81	6.21	1.51	10.53	2.75
Pet.Ether-Eucalyptus	7.60	37.50	20.00	65.10	2.53	6.20	4.27	13.00	4.14
Ethanol-Tomato	8.70	13.00	9.50	31.20	2.00	4.96	3.40	11.08	3.07
Chloroform-Tomato	27.80	13.50	11.20	52.50	2.72	1.58	2.39	8.97	1.99
Pet.Ether-Tomato	11.20	26.70	10.80	48.70	1.98	2.50	2.69	7.17	2.62
Control (inf. Plants)	1.80	6.70	1.70	10.20	0.47	0.55	0.80	1.82	2.87
Control (heal. Plants)	7.10	6.90	3.50	17.50	1.30	0.60	2.01	3.98	2.06
L.S.D. at 5%	2.36	2.87	1.66	2.84	0.74	0.25	0.43	0.81	0.10

It was noticed that, *Lantana camara* extracts with all solvents used and *Eucalyptus* extracts with petroleum ether, as well as, tomato extracts with chloroform and petroleum ether significantly stimulated the growth of stem, tomato extract with ethanol had no significant effect, meanwhile *Eucalyptus* extract with chloroform significantly inhibited it, if compared with both controls (healthy and infested). The tallest stem was recorded by the petroleum-etheric and chloroformic extracts of *Lantana* followed by ethanolic and petroleum-etheric extracts of *Eucalyptus* and ethanolic extract of *Lantana*.

Treatments with pet.- etheric extract of *Lantana*, ethanolic extract of *Eucalyptus* and all extracts of tomato stimulated the root growth, meanwhile the ethanolic and chloroformic extracts of *Lantana*, as well as, the chloroformic extract of *Eucalyptus* inhibited it. The extract of *Eucalyptus* by ethanol gave the tallest root (an increase in it by 288.9% over the infested plants and 79.5% over the healthy plants).

The root size (RS) of the infested plants was significantly increased when the plants were treated with all plant extracts except of tomato extract with ethanol, which had no effect in this respect. The maximum RS was obtained by treating with the petroleum-etheric extract of *Lantana camara* followed by the chloroformic extract of tomato.

All plant extracts except the ethanolic extract of tomato significantly increased the number of leaves. The best treatments in this respect were the petroleum etheric extracts of both *Lantana* and *Eucalyptus*.

All plant extracts increased the leaf length (LL) and the pet.-etheric extracts recorded the maximum LL (Table, 2).

The maximum leaf width (LW) was observed in the petr.-etheric extracts of both *Eucalyptus* and tomato plants if compared with the other extracts.

Most of plant extracts caused a great increase in total leaf area (LA) and little of them caused the reverse. All types of plant extracts of *Lantana*, petr.-etheric of *Eucalyptus* and ethanolic extract of tomato gave the greatest leaf area.

All treatments of plant extracts showed a significant increase in leaf area index (LAI) when compared with the control of the infested plants. The highest values of LAI were given by all extracts of *Lantana camara*, followed by petr.-etheric of *Eucalyptus* and ethanolic extract of tomato.

Concerning the fresh and dry weights of plant organs, it was observed that, the effects of the treatments of the chloroformic extract of *Eucalyptus* on the dry weight of leaves, the ethanolic extracts of *Lantana*, *Eucalyptus* and tomato as well as the chloroformic and petr.-etheric extracts of *Eucalyptus* on the fresh weight of roots were not significant, meanwhile the chloroformic extract of *Lantana camara* significantly inhibited it, others extracts significantly increased it, if compared with the healthy control plants (Table, 3). On the other hand, the obtained results in the same Table show that, the infested plants treated with all plant extracts by different solvents (ethanol, chloroform, petr.-ether) showed high significant increases in the fresh and dry weights of roots, stem, leaves and whole plant. The highest increase in the fresh and dry weights of roots, stems and leaves was occurred by the extract of *Lantana camara* with petr.-ether. Regarding to the Shoot/Root ratio (S/R), it can be revealed that the highest ratios were obtained by ethanolic extract of *Lantana camara* and petr.-etheric extract of *Eucalyptus*, whereas the lowest one by chloroformic extract of tomato.

In this connection, Ragab (1997) revealed that, all crude juice of black night shade, dwarf nettle, *Lantana camara*, onion, garlic and cabbage increased the growth characters of pea plants infested with different pathogens under greenhouse conditions. Moreover, Gaafar *et al.* (1989) reported that, some plant juice such as garlic and onion increased the length of root and stem as well as the fresh and dry weights of the infested tomato plants.

The marked increment in growth of the infested maize plants as a result of using plant extracts may be due to containing these extracts some substances or natural metabolites e.g. Tannins, flavonoids and alkaloids, which inhibit the growth of fungi (Bonner and Varner, 1965; Ganguly, 1994; Pandy and Pant,1997; Hernandez-Anguiano *et al.*,1998), and/or played an important role in the chemical defense of plant (Wink and Twardowski, 1992); and due to some growth promoters, e.g. saponins and steroids (Bonner and Varner, 1965), consequently, all these factors led to marked increases in all tested growth parameters.

Photosynthetic pigments:

It is obvious from data recorded in Table (4) that, the concentrations of chlorophylls a, b and total as well as carotenoids in the leaves of

Table (4): Effect of some plant extracts on the concentrations of photosynthetic pigmements as well as the ratios of Chl.a / b and total Chl. / Carotenoids in the leaves of maize plants grown in soil infected with *Fusarium moniliforme* under greenhouse conditions after 80 days from sowing.

Characters / Treatments "Plant extracts at 5%"	Chl.a	Chl. b	Total Chl.	Carotenoids	Chl.a/b ratio	Total Chl./ Caroten. ratio
	mg/g dry wt.					
Ethanol-Lantana	2.05	1.00	3.05	2.56	2.05	1.19
Chloroform-Lantana	2.15	0.37	2.52	2.67	5.81	0.94
Pet.Ether-Lantana	2.28	0.51	2.79	1.25	4.44	2.23
Ethanol-Eucalyptus	1.80	0.94	2.74	2.03	1.92	1.35
Chloroform-Eucalyptus	2.80	0.59	3.39	3.95	5.60	0.86
Pet.Ether-Eucalyptus	1.80	0.92	2.72	2.06	1.90	1.32
Ethanol-Tomato	1.64	0.86	2.50	1.71	1.91	1.46
Chloroform-Tomato	1.71	0.37	2.08	2.61	4.62	0.80
Pet.Ether-Tomato	2.15	0.80	2.95	3.00	2.69	0.98
Control (inf. Plants)	0.80	0.22	1.03	1.77	3.68	0.58
Control (heal. Plants)	2.33	0.91	3.24	3.31	2.56	0.98
L.S.D. at 5%	0.45	0.20	3.04	0.75	0.24	0.63

maize plants infested by *Fusarium moniliforme* were lower than that of healthy plants. The reductions reached about 65.7% (chl.a) 75.8% (chl. b), 68.2% (total chl.) and 46.5% (carotenoids). The ratio of chl. a/b in the leaves of the infested plants was higher than that of the healthy plants. A marked decrease was recorded in the ratio of total chl./carotenoids in the infested plants if compared with the healthy plants. Similar results were reported by Herger and Klingauf (1990). The deleterious effect of the infection by Fusarium on the pigments of photosynthesis might be due to that fungi of *F. moniliforme* secrets toxic substances that might be stimulate the activity of chlorophyllase and chlorophyll degradation, and/or it decreases the carotenoids that prevent chlorophyll photodestruction as shown from our results (Table, 4), or/and might be inhibited Fe uptake and transport to plant leaves (Fay *et al.*, 1995).

The infested plants treated with the chloroformic extract of *Eucalyptus* showed a significant increase in the concentration of chl.a. The extracts of *Lantana* had no significant effect, while other extracts reduced its concentration but not arrive to the level of significant. The concentration of chl.b in the infested plants was significantly increased as a result of treating them by ethanolic extract of *Lantana*, petr.-etheric extract of *Eucalyptus* and the extracts of tomato by ethanol and petr.-ether, but not significantly affected by petr.-etheric extract of *Lantana*, the extracts of *Eucalyptus* by ethanol and chloroform, and significantly reduced by chloroform extracts of both *Lantana* and tomato. Concerning the effect on the concentration of total chlorophyll, it was observed that some plant extracts such as chloroformic extract of *Eucalyptus* and ethanolic extract of *Lantana* significantly increased its concentration, while other extracts had no significant effect. Regarding the effect of plant extracts on the concentration of carotenoids, the chloroformic extract of *Eucalyptus* and petr.-etheric extract of tomato increased it significantly, while the petr.-etheric extracts of both *Lantana* and *Eucalyptus* as well as the ethanolic extract of tomato decreased it, and other extracts had no significant effect.

The ratio of chl. a/b tended to be decreased when the infested plants treated with all types of extracts used. On the other hand, all extracts used raised significantly the ratio of total chl./carotenoids.

In this regard, Herger and Klingauf (1990) found that, chlorophyll contents in the infested apples, Begonia, cucumbers, grapes, *Phaseolus vulgaris* and carnations by different causal fungi were increased when these plants were treated with aqueous and ethanolic extracts of fresh and dry leaf material of some plants

The stimulatory effect of the tested plant extracts on the photosynthetic pigments might be due to substances that act as activators for chlorophyll synthesis (Bonner and Varner, 1965) and/or inhibit the effect of causal fungi on chlorophyll degradation and Fe uptake as well as carotenoids.

Water relations:

Data illustrated in Table (5) indicate that, the leaf water content, as well as, the transpiration rate of the infested plants were less by about 9.3 and 20.7% than that of the healthy plants, respectively. Decreasing the water content and the water loss as a result of the infection by *F. moniliforme* might be due to its producing to toxic substances that cause decrease in water uptake by roots.

It is evident that, all extracts of *Lantana*, the chloroformic and petr.-etheric extracts of *Eucalyptus* and the petr.-etheric of tomato caused a significant increase in the leaf water content, whereas the ethanolic extracts of both *Eucalyptus* and tomato decreased it, others had no effect. It was also observed that, the most of extracts (with exception of some extracts) significantly did not change the leaf water content when compared with the healthy plants.

All types of plant extracts except of the chloroformic extract of *Eucalyptus* raised the rate of the water loss from the infested plants. Moreover, no significant differences were observed among the treatments of all types of extracts. Also, the transpiration rate in the infested plants treated with all extracts of *Lantana*, petr.-ether of *Eucalyptus* and all extracts of tomato was higher than that in the healthy plants, the ethanolic extract of *Eucalyptus* did not show any difference, while the chloroformic extract lowered it.

The increase in water content as a result of applying the tested plant extracts might be attributed to the action of some chemical compounds presented in these plant extracts in stimulating the root growth system (root length and size) as shown from our results, as well as, its role in regulating the water uptake and loss (Bonner and Varner, 1965).

Activity of enzymes:

Table(5): Effect of some plant extracts on the total water content, transpiration rate as well as the activities of polyphenoloxidase and peroxidase in the leaves of maize plants grown in soil infected with *Fusarium moniliforme* under greenhouse conditions after 80 days from sowing.

Characters / Treatments "Plant extracts at 5%"	Water relations		Enzymes activity	
	Total water content (%)	Transpiration rate ($mg.cm^{-1}.h^{-1}$)	Phenol-oxidase (O.D./g FWt. at 45 min.)	Peroxidase (O.D. / g FWt. at 3 min)
Ethanol-Lantana	90.74	2.062	0.646	1.001
Chloroform-Lantana	80.47	2.518	1.159	0.858
Pet.Ether-Lantana	88.13	2.070	0.415	0.920
Ethanol-Eucalyptus	55.23	1.915	0.868	0.555
Chloroform-Eucalyptus	78.95	1.516	0.159	0.615
Pet.Ether-Eucalyptus	92.45	2.177	0.177	1.100
Ethanol-Tomato	55.05	2.250	0.201	1.055
Chloroform-Tomato	69.64	2.670	0.392	0.915
Pet.Ether-Tomato	77.87	2.682	0.287	0.889
Control (inf. Plants)	70.00	1.564	0.259	0.837
Control (heal. Plants)	77.14	1.971	0.149	0.296
L.S.D. at 5%	1.31	0.24	0.083	0.084

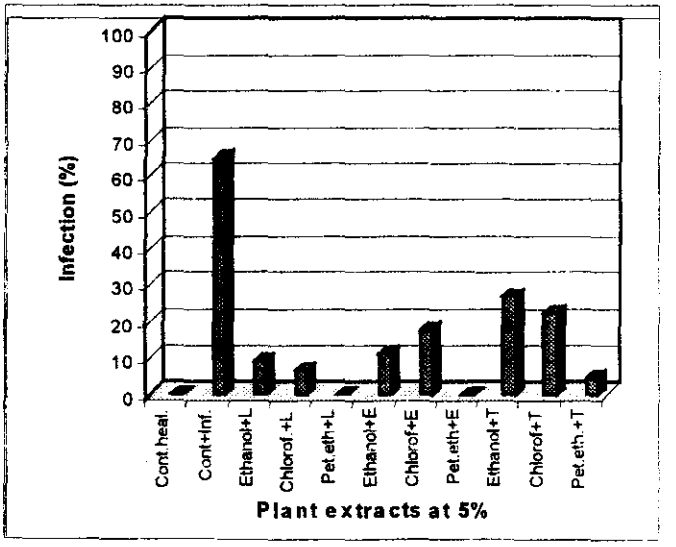

Fig. (1): Effect of some plant extracts on the infection with stalk rot disease in maize in maize plants grown in soil infested with *Fusarium moniliforme* under under greenhouse conditions.

The obtained results in Table (5) show that, the activity of both peroxidase and phenoloxidase in the infested plants was higher by about 3 times (peroxidase) and two times (phenoloxidase) if compared with the healthy plants. Similar results were mentioned by Atia *et al.* (1982) who reported that, peroxidase and phenoloxidase activities increased in response to infection and were higher in the resistant wheat cultivar than that in the susceptible one.

It was also noticed that, the activity of peroxidase was significantly lowered when the infested plants were treated by some plant extracts such as chloroformic and ethanolic extracts of *Eucalyptus*, whereas the ethanolic extracts of both *Lantana* and tomato and the petr.-ether of *Eucalyptus* increased its activity. Also, the activity of enzyme was still stable or similar to the control of the infested plants when they treated with the chloroformic and petr.-ether extracts of both *Lantana* and *Eucalyptus*. Concerning the activity of phenoloxidase as affected by plant extracts, it was found that all plant extracts (except of the ethanolic extract of tomato and petr.-etheric of *Eucalyptus*) increased the activity of this enzyme. The highest activity in peroxidase was recorded by petr.-ether of *Eucalyptus* and the ethanolic extracts of both *Lantana* and tomato, whereas the highest one for phenoloxidase was recorded by the chloroformic extract of *Lantana* and the ethanolic extract of *Eucalyptus*. It is noteworthy that, using all plant extracts under study caused significant increases in peroxidase and phenoloxidase activities of the infested plants when compared with healthy plants. In this concern, Herger and Klingauf (1990) found that, the activities of various enzymes in the infested apples, Begonia, cucumbers, grapes, *Phaseolus vulgaris* and carnations by different causal fungi were increased when these plants were treated with aqueous and ethanolic extracts of fresh and dry leaf material of some plants.

Infection percentage:

Data illustrated in Fig. (1) indicate that, the infection percentage in the maize plants infested with *F. **moniliforme*** arrived to about 65%. The obtained results are in accordance with those reported by Fu and Zhang (1988); Windls *et al.* (1988); Sun *et al.* (1990); Wu-Qua *et al.* (1997) and Zhu-Hua *et al.* (1997).

Also, data illustrated in the same Fig. show that, treating the infested maize plants with all plant extracts

by different solvents affected the disease infection and minimized its levels as compared to the control of infested plants. The *Lantana* extract with petroleum ether completely inhibited the *Fusarium* infection. Other extracts affected the infection and minimized it between 6.25% and 16.67% when compared with the infested control (65%). Similar results were reported by Herger and Klingauf (1990); Irobi and Daramola (1993); Brinton *et al.* (1996); Pandy and Pant (1997) and Hernandez-Anguiano *et al.* (1998).

The ability of plant extracts to control the disease might be due its containing some natural compounds, i.e. sterols, saponins, alkaloids and flavonoids which act as antifungal substances where they inhibited the mycelial growth and sporulation (Herger and Klingauf,1990; Mukhtar *et al.*,1991; Irobi and Daramola, 1993; Pandy and Pant,1997; Hernandez-Anguiano *et al.*,1998).

It had been demonstrated in this work that, all the tested plant extracts were not only able to control the diseased infection due to its containing some natural compounds, i.e. tannins, saponins, sterols, alkaloids and flavonoids, but also, could stimulate the growth of the infested plants and regulate the physiological and biochemical processes. Also, our results provides a continual inspiration to agrochemists in their research for new products, which might used in control of pathogens and insects if they possess suitable biological and physical properties.

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استجابة نباتات الذرة النامية تحت ظروف غير مناسبة لبعض المستخلصات النباتية

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أستخلصت الأوراق المجففة هوائيا لنباتات اللانتانا و الكافور و الطماطم بمذيبات الايثانول والكلوروفورم و الايثير البترولى واختبرت هذه المستخلصات لوجود بعض المكونات الكيميائية بها وقدرتها على مقاومة الإصابة بمرض عفن الساق فى الذرة الشامية صنف بلدى وكذلك تأثيرها على النمو وبعض الصفات الفسيولوجية لهذه النباتات النامية فى تربة ملوثة ومعدية بفطر الفيوزاريوم المسبب للمرض تحت ظروف الصوبة.

أشارت النتائج إلى أن مستخلصات الايثانول لنبات الكافور والطماطم احتوت على كميات عالية من التانينات والفلافونويدات فى حين اختفت هذه المركبات فى نبات اللانتانا ، كما احتوت جميع النباتات على كميات متوسطة من القلويدات وأثار من الاستيرولات. أما مستخلصات الكلوروفورم للنباتات المستخدمة فقد احتوت جميعها على السابونينات والاستيرولات والتانينات والقلويدات والفلافونويدات ، ووجدت التانينات بكميات عالية فى جميع النباتات بينما وجدت السابونينات بكميات عالية فى الكافور فقط والفلافونويدات بكميات عالية فى اللانتانا فقط مقارنة ببقية النباتات. أما بالنسبة لمستخلصات الايثير البترول فقد احتوت على القلويدات بكميات عالية وأثار من الاستيرولات ولم يوجد فيها كل من التانينات و الفلافونويدات. وقد لوحظ أيضا أن الاختبارات الكيميائية أعطت نتائج سلبية فى جميع المستخلصات النباتية عند الكشف عن الكومارين.

أظهرت النتائج أن صفات النمو فى جميع النباتات المصابة انخفضت معنويا وكانت صفات طول وحجم الجذور ، عدد الأوراق ، عرض الورقة ، مساحة الأوراق ومدلولها ، وكذلك الوزن الطازج والجاف للجذور والأوراق والنبات الكامل هى الأكثر تأثرا بالضرر. وكان الضرر الناشئ فى النمو مصحوبا بنسبة إصابة عالية بلغت ٦٥%. وقد أدى استخدام المستخلصات النباتية إلى تحسين صفات النمو السابق ذكرها بل وتفوقت على النباتات السليمة بالإضافة إلى انخفاض نسبة الإصابة ووصلت إلى صفر% عند استخدام مستخلصات الاثير البترولى لنباتات اللانتانا والكافور.

أظهرت النباتات المصابة نقصا معنويا فى تركيز الكلور وفيلات أ ، ب ، الكلية وكذلك الكاروتنويدات. كما ازدادت نسبة كلوروفيل أ/ب وانخفضت نسبة الكلور وفيلات الكلية/الكاروتنويدات بها. وقد أظهرت صبغات التمثيل الضوئي استجابات مختلفة للمستخلصات النباتية المستخدمة وكان مستخلص الكلوروفورم لنبات الكافور هو الأفضل فى هذا المجال.

كما لوحظ أن محتوى الماء الكلى ومعدل النتح قد انخفض إلى ٩،٣ و ٢٠،٧ % عن النباتات السليمة فى حين ازداد نشاط إنزيمي البيروأوكسيديز و البولى فينول أوكسيديز. وقد أدى استخدام بعض المستخلصات النباتية إلى زيادة المحتوى المائى ومعدل النتح ونشاط الانزيمين فى حين أدى البعض الآخر إلى نقصها.