Control of *Lavandula Dentata* Root Rot with Leaves Extracts of *Lawsonia Inermis* and *Eucalyptus Camaldulensis*

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ABSTRACT: A pot experiment was conducted during 2012 and 2013 seasons in the Experimental Field of the Medicinal and Aromatic Plants Department at Dokky, Giza, to investigate the effect of aqueous extracts of powdered dried henna (*Lawsonia inermis*) and camphor *(Eucalyptus camaldulensis*) leaves separately on Lavender (*Lavandula dentata*) root rot disease, vegetative growth, volatile oil percentage, volatile oil component analysis (GLC). The results were summarized as follow: in all cuts in the two seasons, treatment inoculated with the tested fungus alone all plants died (control). The plants sprayed with *Lawsonia inermis* aqueous extract at high concentration (100g/L) had a highest significant antimicrobial activity against root rot disease, *Lawsonia inermis* aqueous extract showed good inhibitory effect against the tested fungus. As for vegetative growth and volatile oil percentage the application of *Lawsonia inermis* aqueous extract at (100g/L) significantly increased plant height, number of branches , herb fresh and dry weights and volatile oil percentage in most cases in both seasons. Followed by the application of *Eucalyptus camaldulensis* aqueous extract at (100g/L). The lowest values were recorded when the plants were treated with *Eucalyptus camaldulensis* aqueous extract at (50g/L) in the first and second seasons. Regarding GLC analysis, the highest percentage of 1,8-Cineol (the main component of the volatile oil) was produced with *Lawsonia inermis* aqueous extract at (100g/L).

Keywords *Lavandula dentata* root rot disease, *Lawsonia inermis* and *Eucalyptus camaldulensis* leaves aqueous extracts.

INTRODUCTION

The intensive and indiscriminate use of fungicides in agriculture has caused many problems to the environment such as water, soil, animals and food contamination, poisoning of farmers elimination of non target organisms and selection of phytopathogens, pest and weed insensitive to certain active ingredients(Strangarlin *et al*., 1999).To minimize the negative effects of fungicides alternative developed methods to control plant diseases are being used. These methods include the biological control, the induction of resistance and the use of natural products with induction of resistance and or with direct antimicrobial activities (Schwan and Strangarlin, 2005).

The biological control is defined as the use of antagonistic organisms for the control of microorganisms, reducing the amount of inoculum that determines the extent of disease (Cook and Baker, 1983).The induction of resistance promotes the activation of the latent plant defense systems, which manifests itself when it comes into contact with a biotic (Felipini and Di Piero, 2009) on apple and (Strangarlin *et al.,* 2010) on soybean or abiotic elicitor carre and (Barretti *et al.,* 2010) on tomato. The expression resistance of induction both can be used to denote local protection, this is, the induction of a resistance only in the tissues in which it was applied the treatment with the inducing agent, also

can indicate a systemic resistance that manifest far from the tissue where the elicitor was applied (Moraes, 1992).

Henna (*Lawsonia inermis*) belongs to family Lythraceae is small shrub cultivated in many tropical countries and warm temperate reign. It has been used for coloring palms of hands, soles of feed an finger nails and also for personal adornment (Bhuvane and Kuruvilia, 2002). *Lawsonia inermis* plant constituent are made up tannic acid, mucilage and gallic acid, but the main bioactive constituent is 2-hyrooxynaphthoquinon (lawsone). (Singh and Singh, 2001) powdered leaves of this plant in paste form have been used as cosmetic and as remedy in skin diseases and used as external application in headache. *Lawsonia inermis* aqueous extract has been used as natural fungicide (Dahankhar *et al*., 2000). Also, *Lawsonia inermis* aqueous extract has a high antimicrobial activity against potato dry rot disease caused by *Fusarium solani* (Bhardwaj, 2012). Spraying *Lawsonia inermis* aqueous extract is the safe method to control powdery mildew disease of *Zinnia elegans* (Hegazi and El-Kot, 2010).

Some components in *Lawsonia inermis* leaves according to (Duke , 1992)

- **Lawsone (10 ppm)**
  1.4 Naphaquinone
- **Flavonoid glucosde**
  Apigenin-4- glucoside
  Luteolin-3- glucoside
  Luteolin-7-0- glucoside
- **Tannins (50-100 ppm)**
- **Phenolic acid**
  Gallic acid
- **Terpenes**
  Beta- sitosterol
  Mannitol
- **Coumarins(12.7-21.4 ppm)**
- **Sugars**
  Pentosan

Camphor (*Eucalyptus camaldulensis*) belongs to family Myrtaceae, is one of the reputed fast growing trees of the world. It's oil is acrid, bitter, astringent and insect repellent,(Babu *et al*., 2008).

Some components in *Eucalyptus camaldulensis* leaves according to (Duke, 1992)

- **Terpens and their derivatives**
  Beta-Bisabolol, Beta-Elemene, Beta-Pinene
  Borneol, Cadinadiene, Cadinenol, Cadineol
  1-8Cineole(24-48ppm), Geraniol, Eugenol
  &-Terpineol- Citronellol, Camphene
  Cuminalcohol, Cuminaldehyde, Camphor
  Eucalyptol
- **Phenolic acidsglocosid**

lavender (*Lavandula dentata*) belongs to family Lamiaceae. *Lavandula dentata* is one of the most useful medicinal and aromatic plants. Commercially, it is an important source of essential oil that is widely used in fragrance industry including soaps, colognes, perfumes, skin lotions and other cosmetics (Paul *et al.,* 2004). In food manufacturing, lavender essential oil is employed in flavoring beverages, ice –cream, candy, baked goods and chewing gum (Kim and Lee, 2002) . Recently, aromatherapy is becoming increasingly popular and *Lavandula dentata* is used in aromatherapy as a relaxant (Lis –Balchin and Hart, 1999).Several therapeutic effects of *Lavandula dentata*, such as sedative, antiviral and antimicrobial activities have been reported (Gamez *et al.,* 1990 ; Buchbauer *et al.,* 1991).

Lavandula dentata essential oil are advocated for their use as antibacterial agent in both early and modern aromatherapy texts (Lawless,1992; Gattefosse,1995). *Lavandula dentata* is exposed to many diseases and root rot is one of the *Botryodiplodia theobromae* (Pat.) Griff. and Maubl. (Syn: *Lasiodiplidia theobromae* Pat.) and its asexual state, *Botryosphaeria rhodina* (Berk and M.A. Curtis) Arx are fungal pathogens of great economic importance.It is a cosmopolitan fungus causing both field and storage diseases on more than 280 plant species including crops, fruits, and cash fruit trees .*B. theobromae* is an opportunistic plant pathogen that causes different types of plant diseases within tropical and subtropical regions (Faber *et al*., 2007). It has a wide host range estimated to be more than 280 plant species (Domsch *et al*., 2007;Khanzada *et al.*, 2006; Sutton 1980) although with varied pathological effects on its hosts. The fungus is known to cause tuber rots in yam, root rot in cassava, collar rot in peanuts, crown rot in banana, stem end rot in mango fruits, stem rot in pawpaw and leaf spot in citrus (Sangeetha *et al.,* 2011; Rossel *et al.,* 2008; Khanzada *et al.,* 2004). Rots caused by the fungus, particularly in the root and tuber crops often occur underground and so diagnosis of the disease is usually delayed or under repaired. Moreover, the wider host range (Crammer, 1979) and the host non- specificity of *B. theobromae* makes control and management of the disease very difficult.

Nawadays synthetic fungicides are used as primary tools for the control of plant diseases. However, the alternative control methods are needed because of the negative public perceptions about using synthetic chemicals, resistance to fungicide among fungal pathogens, and high development cost of new chemicals. The uses of plant-derived products as disease control agents have been studied, since they tend to have low mammalian toxicity, less environmental effects and wide public acceptance (Lee *et al.,* 2007; Katooli *et al*., 2011).

The aim of this research was to examin the antifungal activity of aqueous extracts of *Lawsonia inermis* and *Eucalyptus camaldulensis* leaves separately to control of *Lavandula dentata* plants root rot disease .

MATERIALS AND METHODS

This experiment was conducted at the Experimental Field of the Medicinal and Aromatic Plants Department at Dokky, Giza, Egypt, in two successive seasons 2012 and 2013.

1. Preparation of Plant extracts

Lawsonia inermis and *Eucalyptus camaldulensis* aqueous extracts were prepared by soaking (100g) of powdered dried leaves in tap water for 24 hours and then they were filtered. Each extract was concentrated at (50 and 100g/L) (Babu *et al.,* 2008).*Lavandula dentata* plants were sprayed four times with aqueous extracts of *Lawsonia inermis* and *Eucalyptus camaldulensis* separately. The first spray was conducted after planting, the second was done three weeks there after, the third was applied after the 1st cut and the fourth was added three weeks after the third one.

2.Experimental procedure

2.1.Isolation and identification of causal pathogen (*Botryodiplodia theobromae*)

Naturally infected plants showed root rot disease symptoms, collected from El –Ekhlas Farm at Giza ,were cut into pieces 5mm long .These pieces were surface sterilized for 3min. with 3% sodium hypochlorite and rinsed in 4 successive changes of sterile distilled water then left to dry on Whatman No. 1 filter paper .The surface sterilized pieces were transformed to potato dextrose agar (PDA) medium in petri dishes and incubated at 27± 2ºC for 5 days . Pure cultures, made by single spore technique, was identified using cultural, morphological and microscopical characters according to (Barnett and Hunter, 1981).

2.2.Soil infestation with the pathogenic fungus

Isolated pathogen *Botryodiplodia theobromae* was grown on sand –corn medium(1:1w:w and 40% water) for 15 days at 25± 2ºC.Pots (30cm diameter) containing sterilized sandy loam soil were artificially infested separately with prepared fungal inoculum at the rate 3% of soil weight .The inoculum was mixed thoroughly with the upper layer of the soil then irrigated every other day and left for 7 days to ensure the distribution of the inoculum. Each treatment was replicated three times every replicate consisted of nine pots (1 plant / pot) and nine ones left without infestation to serve as control. Root rot percentage was recorded 45 days after planting.

2.3 Source of cutting

Lavandula dentata cutting (15-20) cm in height were obtained from El-Ekhlas Farm at Giza and planted in plastic pots (30cm diameter) on 25th February, 2012 and 2013 in the first and second seasons, respectively.

3. Experiment layout

The experiment layout was designed in complete randomized blocks included five treatments each treatment was replicated three times and every replicate consisted of nine pots (1plant /pot), the recorded data were statistically analyzed according to Snedecor and Conchran (1968), using L.S.D at 5% .

4. Chemical fertilization

The sources of chemical fertilizers (NPK) were ammonium sulphate (20.6%N), calcium superphosphate (15.5% P_2O_5) and potassium sulphate (48%K_2O). (NPK) fertilizers were added at the recommended level in five doses, the 1st was for all phosphorous amount which was added during soil preparation, the rest (NK) were applied in two equal doses for each cut, on 8 th April and 10 th May for the1stcut and on 10 th June (after the1st cut) and 9 th July for the 2ed one in the two seasons. The plants were harvested twice, the first cut was conducted on 7th June and the second one on 8 th August in both seasons.

5.Treatments

1.Control (*Botryodiplodia theobromae* fungus all plants died and were not subject to statistical analysis) .
2.*Botryodiplodia theobromae* fungus+ *Lawsonia inermis* aqueous extract at (50g/L).
3.*Botryodiplodia theobromae* fungus +*Eucalyptus camaldulensis* aqueous extract at (50g/L).
4.*Botryodiplodia theobromae* fungus + *Lawsonia inermis* aqueous extract at (100g/L).
5.*Botryodiplodia theobromae* fungus +*Eucalyptus camaldulensis* aqueous extract at (100g/L).

6.Data recorded

The following data were recorded

1. Identification of causal pathogen (*Botryodiplodia theobromae*)
2.Percentage of root rot.
3.Plant height and number of branches /plant.
4.Herb fresh and dry weights (g/plant).
5.Volatile oil percentage in fresh herb according to (British Pharmacopeia, ,1963).

7.Volatile oil component

Sample taken from the oil obtained in the first cut of the first season were analyzed using gas liquid chromatography (GLC), to determine their main constituents. The use of GLC in the quantitative determinations was performed using the methods described by (Bunzen *et al.,* 1969; Hoftman, 1967).

RESULTS AND DISCUSSION

1. Identification of causal pathogen

Associated with root rot symptoms was a fungus that had the following morphology: solitary pycnidia, pyriform, black, 150–175 X190–210 mm, glabrous, with an apical ostiole, stromatic wall, composed of several layers of dark brown, thick-walled cells; conidia ellipsoidal, one-celled, hyaline when immature becoming dark brown, striate and didymospore with age ,22.0–28.5 X12.5–14.0 mm. The fungus fits the description of *Botryodiplodia theobromae* (Pat.) Griffon & Maubl. (Punithalingam, 1976 ; Barnett and Hunter, 1981).

2. Percentage of root rot

Aqueous extracts of *Lawsonia inermis* and *Eucalyptus camaldulensis* were tested for their antifungal ability to control root rot disease of *Lavandula dentata* caused by the pathogenic fungus *Botryodiplodia theobromae* . Data in Table (1) clearly emphasized that, *Lawsonia inermis* and *Eucalyptus camaldulensis* aqueous extracts separately control root rot disease . It is obvious that resistance agents significantly decreased the incidence of root rot disease, *Lavandula dentata* plants were protected by aqueous extracts of *Lawsonia inermis* and *Eucalyptus camaldulensis* separately. The most effective treatment was aqueous extract of *Lawsonia inermis* at 100g / L in both seasons. This result may be due to medicinal and aromatic plants represent a rich source of antimicrobial agents (Mahesh and Satish, 2008). Plants generally produce many secondary metabolites, fungicides and many pharmaceutical agents used in traditional medicine (Ibrahim, 1997; Ogundipe *et al.,* 1998).Medicinal and aromatic plants are the sources of natural fungicides that make excellent leads for new fungicides development (Arokiyara *et al.,* 2008; Brindha *et al*., 2009). Also Medicinal and aromatic plants have limitless ability to synthesize aromatic secondary metabolites, most of which are phenols or their oxygen subatituted derivatives (Geissman, 1963). Important subciasses in this group of compounds include phenols, phenolic acids, quinones, flavones, flavonoids, tannins, coumarins and essential oils. These groups of compounds show antimicrobial effect and serves as plant defense mechanisms against pathogenic microorganisms. Simple phenols and phenolic acid are bioactive phytochemicals consisting a single substituted phenolic ring. Phenolic toxicity to microorganisms is due to the sites and number of hydroxyl groups present in the phenolic compound(Scalbert, 1991; Urs and Dunteavy, 1975).Quinones are characteristically highly reactive, colored compounds. These results were in accordance to (Bambawale *et al.,* 1995) on cotton found that, *Lawsonia inermis* aqueous extract inhibited spore germination and mycelial growth *of Myrothecium roridum*. Also, (Bakeer *et al.,* 2005) on *Pelargonium graveolens* reported that, garlic (*Allium sativum*) and onion (*Allium cepa*) extracts significantly decreased the incidence of *Pelargonium graveolens* root rot disease. (Sharma *et al.,* 2010) on kinnow fruits observed that, *Allium sativum* aqueous extract inhibited 100%of mycelial growth of *Botryodiplodia theobromae* followed by aqueous extract of *Lawsonia inermis* which reduced 73.64% of rot incidence.

Table 1. Effect of *Lawsonia inermis* and *Eucalyptus camaldulensis*s leaves extracts on percentage of root rot of *Lavandula dentata* plants during 2012 and 2013 seasons

Treatments	% root rot			
	Season 2012	Efficacy %	Season 2013	Efficacy %
Control(*Botryodiplodia theobromae* fungus)	100.00	0.0	100.00	0.0
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (50g/L)	41.60	53.70	38.90	56.70
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract (50g/L)	46.60	48.20	44.40	50.60
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (100g/L)	27.50	69.10	25.50	72.20
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract(100g/L)	39.60	56.00	36.60	59.30
LSD at 5%	15.40	-	14.60	-

The same results were obtained by (Hegazi and El-Kot, 2010) found that, spraying *Zinnia elegans* plants with *Lawsonia inermis* aqueous extract inhabited powdery mildew caused by *Erysiphe cichoracearum* fungus. In the same way, (Tariqu *et al.,* 2010) on *Gladiolus grandiflorus* stated that, spraying both aqueous extracts of *Allium sativum* and *Allium cepa* reduced incidence of corm rot disease caused by *Fusarium oxysporium* fungus.

3.Vegetative growth

3.1.Plant height and number of branches/ plant

Data in Table (2) indicated that, treatment inoculated with *Botryodiplodia theobromae* fungus alone all plants died (control), also both aqueous extracts of *Lawsonia inermis* and *Eucalyptus camaldulensis* had a significant increased in plant height and number of branches / plant in the two seasons. The tallest plants in the first and second seasons at the two cuts were recorded by the plants were treated with aqueous extract of *Lawsonia inermis* and *Eucalyptus camaldulensis* separately at 100g/L which gave (36.36, 34.77cm) and (29.16, 27.36 cm) at first and second cuts in the first season, respectively. The same trend was observed in the second season giving (32.50, 31.77 cm) and (26.97,25.30 cm). The shortest plants in the two cuts of the first and second season were treated with aqueous extract of *Eucalyptus camaldulensis* at 50 g / L as shown in Table (2).The same trend was observed in the case of number of branches. The application of *Lawsonia inermis* aqueous extract also had a significant effect on number of branches/plant, the highest number of branches was recorded when plants were sprayed with *Lawsonia inermis* aqueous extract at 100g/L giving 9.35 and 10.07 at first and second cuts, respectively, while in the second season the recorded data were 12.01 and 13.15 at first and second cuts, respectively. The lowest values were recorded when the plants were sprayed with *Eucalyptus camaldulensis* aqueous extract at 50g/L in the first and second cuts at the first season giving (7.46 and 8.90).The same trend was observed in the second season giving (9.60, 10.96) at the first and second cuts. These results may be due to *Lawsonia inermis* aqueous extract contains lawsone ($C_{10}H_6O_3$),the active
ingrediend and naturally occurring naphthoquinone (Habbal *et al.,* 2007) and the presence of eucalyplol in *Eucalyptus camaldulensis* aqueous extract (Babu *et al.,* 2008).These results are in agreement with that obtained by (Tariqu *et al.,* 2010) on *Gladiolus grandiflorus***.**

3.2.Herb fresh and dry weights (g/ plant)

Data in Table (3) revealed that, treatment applied with the tested fungus alone all plants died (control). Spraying aqueous extracts of *Lawsonia inermis* and *Eucalyptus camaldulensis* separately had a significant effect on herb fresh and dry weights in most cases in the two seasons. The best results were obtained from *Lawsonia inermis* aqueous extract. The highest fresh and dry weights /plant were recorded when *Lavandula dentata* plants were sprayed with *Lawsonia inermis* aqueous extract at 100g/L giving 37.15, 39.31 g /plant and 41.43, 48.44 g/plant fresh weight and 15.47, 19.88 g/plant and 28.09,37.12 g/plant dry weight in the first and second seasons respectively.

Table 2. Effect of *Lawsonia inermis* and *Eucalyptus camaldulensis* leaves extracts on plant height and number of branches of *lavandula dentata* plants during 2012 and 2013 seasons

Plant height				
	1st season		2 ed season	
Treatments	1st cut	2 ed cut	1st cut	2 ed cut
Control(*Botryodiplodia theobromae* fungus)	0.0	0.0	0.0	0.0
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (50g/L)	23.81	22.05	21.80	20.15
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract (50g/L)	23.23	20.42	20.17	19.67
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (100g/L)	36.36	34.77	32.50	31.77
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract(100g/L)	29.16	27.36	26.97	25.30
LSD at5%	3.326	3.664	4.044	4.962
Number of branches				
Control(*Botryodiplodia theobromae* fungus)	0.0	0.0	0.0	0.0
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (50g/L)	8.56	9.43	9.99	11.33
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract(50g/L	7.46	8.90	9.60	10.96
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (100g/L)	9.35	10.07	12.01	13.15
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract(100g/L)	9.07	9.94	11.00	12.18
LSD at 5%	1.028	0.955	0.686	0.784

These results may due to the presence of the secondary metabolites, flavonoids, tannins, phenols and anthraquinones in *Lawsonia inermis* aqueous extract, the plant extracts may be considered as good sources of natural antioxidants for medicine uses (Arulpriya and Lalitha, 2012). These results are in harmony with (Muhammed, 2005; Tariqu *et al.*, 2010).

4.Volatile oil percentage

Data in Table (4) showed that, all plants died when they were treated with the pathogenic fungus alone (control). Essential oil percentage of *Lavandula dentata* fresh herb were significantly responded to plant extracts (natural fungicides) in the first season at the two cuts . The high concentration of *Lawsonia inermis* aqueous extract (100g/L) had a highest fungitoxic activity against *Lavandula dentata* root rot, which gave the highest oil percentage the values were 0.367 and 0.427% at the first and second cuts in the first season respectively. While in the second season the differences between the treatments were not significant. The lowest volatile oil percentage was obtained when the plants were sprayed with *Eucalyptus camaldulensis* aqueous extract at 50 g/L in the two seasons.The increment in volatile oil percentage may be due to medicinal and aromatic plants are the sources of natural fungicides because plants produce secondary metabolites such as phenols, phenolic acids, quinones, flavones, flavonoids, flavonols, tannins, coumarins and essential oils. These groups have antimicrobial effect against pathogenic microorganisms (Das *et al.,* 2010).

5. GLC analysis of essential oil

The GLC analysis were carried out on the essential oil of *Lavandula dentata* plants of two treatments in the first cut of first season, *Eucalyptus camaldulensis* aqueous extract (50g/L) and *Lawsonia inermis* aqueous extract (100 g / L). Data were recorded in Table (5) and Figures (1-2) revealed that, 1,8- Cineol was the main component. It was observed that content of 1,8-Cineol tended to increase up to 46.48 % in case of *Lawsonia inermis* aqueous extract (100g/L).

Table 3. Effect of *Lawsonia inermis* and *Eucalyptus camaldulensis* leaves extracts on herb fresh and dry weights /plant (g) of *Lavandula dentata* plants during 2012 and 2013 seasons

Treatments	1st season		2 ed season	
	1st cut	2 ed cut	1st cut	2 ed cut
herb fresh weight /plant(g)				
Control(*Botryodiplodia theobromae* fungus)	0.0	0.0	0.0	0.0
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (50g/L)	34.61	36.07	36.94	44.17
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract(50g/L	33.60	34.42	34.97	42.72
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (100g/L)	37.15	39.31	41.43	48.44
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract(100g/L)	35.07	38.33	40.78	47.52
LSD at 5%	3.189	NS	5.428	4.927
herb dry weight /plant(g)				
Control(*Botryodiplodia theobromae* fungus)	0.0	0.0	0.0	0.0
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (50g/L)	10.94	17.47	24.64	34.47
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract(50g/L	8.75	16.08	20.27	30.48
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (100g/L)	15.47	19.88	28.09	37.12
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract(100g/L)	13.13	18.03	26.25	35.33
LSD at 5%	2.612	3.517	4.255	3.831

Table 4. Effect of *Lawsonia inermis* and *Eucalyptus camaldulensis* leaves extracts on volatile oil percentage of *Lavandula dentata* plants during 2012 and 2013 seasons

Volatile oil percentage (in fresh herb)				
	1st season		2 ed season	
Treatments	1st cut	2 ed cut	1st cut	2 ed cut
Control(*Botryodiplodia theobromae* fungus)	0.0	0.0	0.0	0.0
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (50g/L)	0.220	0.407	0.453	0.500
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract (50g/L	0.200	0.373	0.447	0.493
Botryodiplodia theobromae fungus +*Lawsonia inermis* extract (100g/L)	0.367	0.427	0.460	0.520
Botryodiplodia theobromae fungus +*Eucalyptus camaldulensis* extract(100g/L)	0.273	0.413	0.454	0.513
LSD at 5%	0.086	0.031	NS	NS

Table 5. Effect of *Lawsonia inermis* and *Eucalyptus camaldulensis* leaves extracts on volatile oil components % of *Lavandula dentata* plants in the 1St Season (1St cut).

Treatments / Volatile oil components	*Eucalyptus camaldulensis* aqueous extract (50g/L) %	*Lawsonia inermis* aqueous extract (100g/L) %
α-Pinene	4.15	4.20
1,8- Cineol	45.25	46.48
Sabinene	15.89	15.96
Linalool	9.91	9.94
Bicyclo(3,1) Hexan -3Ol,4 Methylene	7.76	7.78
Bicyclo(3,1,1) Heptan-2-One, 6,6-Dimethyl	4.36	4.39
αCampholene Aldehyde	0.92	0.95
p-Cymene	0.46	0.47
Camphene	0.99	1.00
Verbenone	1.02	1.11

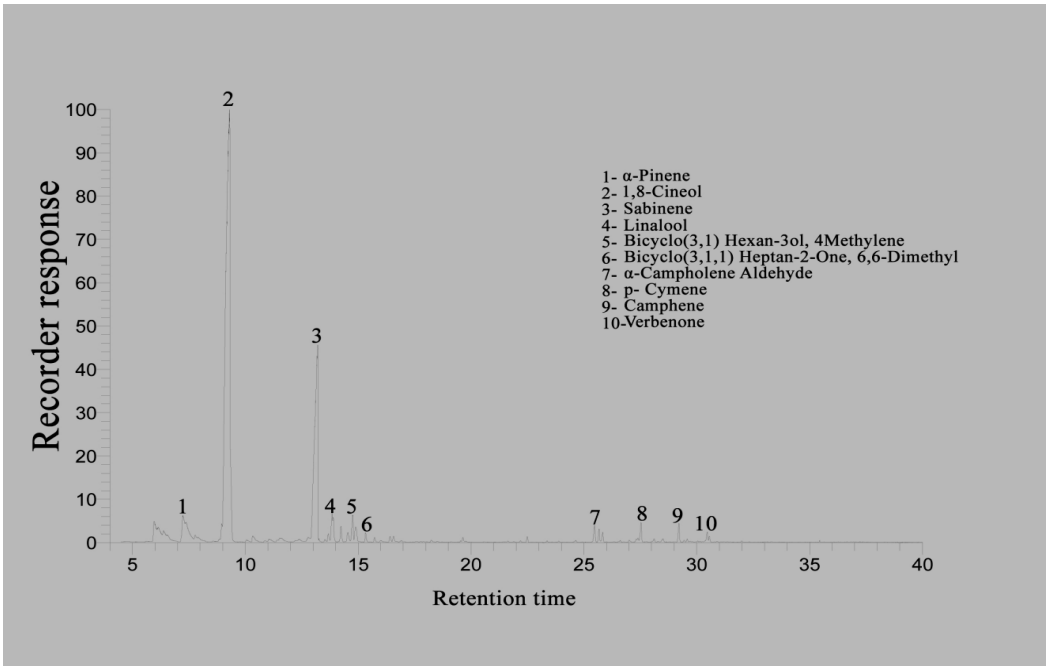

Figure 1. Chromatogram of *Lavandula dentata* volatile oil distilled from plants sprayed with *Eucalyptus camaldulensis* leaves aqueous extract at (50g/L)

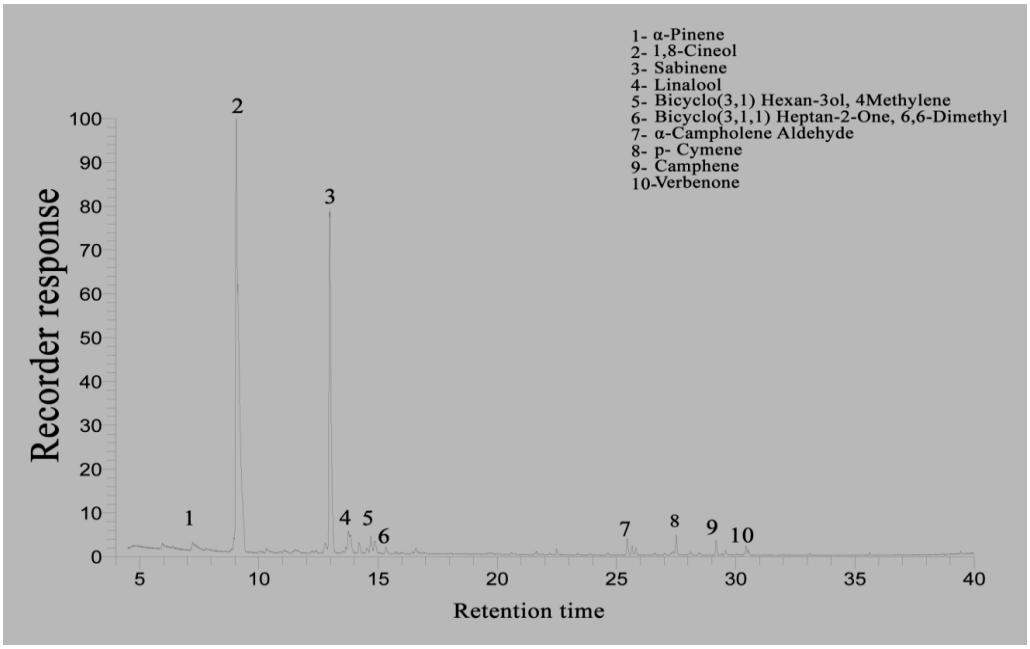

Figure 2. Chromatogram of *Lavandula dentata* volatile oil distilled from plants sprayed with *Lawsonia inermis* leaves aqueous extract at (100g/L).

CONCLUSION

It could be concluded that *Lawsonia inermis* aqueous extract at high concentration (100g/L) had a highest (natural fungicide) fungitoxic activity against *Lavandula dentata* root rot disease and it had a positive effects on vegetative growth and volatile oil percentage.

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الملخص العربي

مقاومة عفن جذور اللافندر باستخدام مستخلصات أوراق الحناء والكافور

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اجريت هذه التجربة فى مزرعة قسم بحوث النباتات الطبية والعطرية بالدقى خلال موسمى 2013/2012 بهدف دراسة تأثير الرش بالمستخلص المائى لكلا من الحناء والكافور منفردين بتركيز (100,50 جرام /لتر). على مرض عفن الجذور فى نبات اللافندر وكذلك النمو الخضري ونسبة الزيت ومكونات الزيت وكانت اهم النتائج كما يلى:ادي رش نباتات اللافندر بالمستخلص المائى للحناء بتركيز 100جرام / لتر الى اعاقه نمو ونشاط الفطر المسبب للمرض وكذلك ادي الى زيادة النمو الخضري ونسبة الزيت زيادة معنوية وذلك فى اغلب الحالات فى كلا الموسمين. وقد سجلت النباتات التى عوملت بالمستخلص المائى للكافور بتركيز 50جرام/ لتر اقل قيم وذلك فى كلا الموسمين . اما بالنسبة لتحليل مكونات الزيت فقد ادى الرش بالمستخلص المائى للحناء بتركيز. 100جرام / لترالى الحصول على اعلى نسبة للمكون الرئيسى فى الزيت (السنيول).