Plant Archives Vol. 20 Supplement 1, 2020 pp. 2959-2964 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EVALUATION OF COMPOSTING BIOMASS OF *EUCALYPTUS CAMALDULENSIS* RESIDUE IN CONTROLLING ROOT ROT OF CUCUMBER PLANT CAUSED BY *FUSARIUM SOLANI*

Ali F. Merjan[1*], Hassan A. Tummer[2], Zahid N. Kamluddin[3], Ali Y. Al-Husseini[4], Arshad K. Khalaf[4] and Saad N. Nasser[4]

[1*]Biotechnology Department, College of Biotechnology, Al-Qasim Green, University, Al-Qasim city, Iraq.
[2]Genetic engineering Department, College of Biotechnology, Al-Qasim Green, University, Al-Qasim city, Iraq.
[3]Department of Horticulture, College of Agriculture, Al-Qasim Green University, Hilla, Iraq.
[4]Plant protection Department, Babylon Agriculture Directorate, Hilla, Iraq.

Abstract

The biomass of green residue of *Eucalyptus camaldulensis* are often considered to be an environment hostile to crops with which they share the same cultivated areas and often cause damage to them through their allopathic secretions. Moreover modern strategies emphasize the possibility of using them in an environmentally friendly way, biomass were composted for 12 weeks, physical and chemical characteristic were evaluated, the extract of Composted Biomass of *Eucalyptus camaldulensis* Trees Residue (CBECTR) was tested against four pathogenic *Fusarium solani* (Fs) isolates causing root rot to cucumber seedling in laboratory condition and plastic house condition.

Extract of (CBECTR) has a significant inhibition of mycelium development of (Fs) isolates in agar plates through decreasing growth 33- 55 % . (CBECTR) has influence the seeds germination 25 – 30 % that infected with (Fs) isolates .While (CBECTR) in pots exterminate has influence the plant growth of infected plant has been stimulated 33 – 49%, while disease incidence were significantly reduced 39 – 47%

Key word: *Eucalyptus camaldulensis* biomass compost, *Fusarium solani*, Root rot disease, Cucumber plants

Introduction

Eucalyptus camaldulensis belongs to the family myrtaceae. It belonging to perennial woody tree (Inouye *et al.,* 2001). eucalyptus plants has been introduced to the Iraqi environment in the end of 1973, as shade trees, to stop desertification towards agricultural lands, as a green belt around Iraqi cities adjacent to the desert (Habib, *et al.,* 2012), or as plants that decorate green squares, as well as to sustain the limited forest areas in Iraq (Tahir, 2011). This plant is characterized by its rapid growth which generates a huge mass of canopy. During the growth stages of these trees, large amount of biomass are left behind as green waste biomass of residue, these residues cause continuous problems for the local environment. A large amount of allopathic compounds are released from these waste (Tilman *et al.,* 2002).

***Author for correspondence :** E-mail : alimerjan@biotech.uoqasim.edu.iq

The residues of *Eucalyptus camaldulensis* usually produce allopathic compounds that have a persistent effect on plants exposed to these compounds. (Saeed *et. al.,* 2013). It is the appropriate mechanism by which the eucalyptus plant can be use it in his own environment against competing plants, as soon as environmental conditions are appropriate, immediately these compounds start to release and its effect in the appropriate plants (Tahir, 2011).

Bio – remediation of biomass of *Eucalyptus camaldulensis* can be considered sustainable solution to manage the harmful effect of the residue, it also produces high quality organic fertilizers at low cost (Lazcano *et al.,* 2008).

The use of decomposed residues has become very common in modern agricultural techniques in soil pathogens control for being environmentally friendly

Table 1: Both Physical and chemical characteristics of the prepared (CBECTR)

Character	Value
pH	6,35
EC mS /cm	1.23
OM %	87.6
TDS mg/l	25.95
DO µs	25
Fe mg Kg^{-1}	1.8
Mn mg Kg^{-1}	4.09
Zn mg Kg^{-1}	5.8
Mg mg Kg^{-1}	3.466
Cu mg Kg^{-1}	7.81
Ni mg Kg^{-1}	1.17
Pb mg Kg^{-1}	0
N mg Kg^{-1}	0.139
P mg Kg^{-1}	0.571
K mg Kg^{-1}	0.39

Results referred to the high quality of (CBECTR).

agricultural methods of especially after growing concern about the negative impact of pesticides (Fuchs, 2002). Ferguson and Rathinasabapathi (2003) found in field experiments that the addition of green residues of eucalyptus to the soil of the field significantly reduced the germination and growth of rice seedlings.

Merjan and AL- Janabi (2015) found that leaving untreated residues of tomato plants in the field activated the pathogens causing vascular wilt of the tomato plant in the subsequent season, while decaying residues contributed to fighting the pathogens. this study was aimed to evaluating composting biomass of *Eucalyptus camaldulensis* trees residue in controlling root rot causing by *Fusarium solani*, promoting plant growth to cucumber plants.

Materials and Methods

Composting processing

Biomass of *Eucalyptus camaldulensis* trees residue were collected from 82 site of Hillah city of Babylon province, Iraq in July 2018. The composting material were Biomass of *Eucalyptus camaldulensis* trees residue were collected from 82 site of Hillah city of Babylon province, Iraq in July 2018. The composting material were ground, the composition were (V:V): leaves, bark from *Eucalyptus camaldulensis* trees, cow manure 5%, phosphate 0.03%, urea 0.015%. The composting systems: the static pile composting system, the moisture was check every two days for 12 weeks, the composition were (V:V): leaves, cope filling down from *Eucalyptus camaldulensis* trees, cow manure 5%, phosphate 0.03%, urea 0.015%. The composting systems: the static pile composting system, the moisture was check every two days for 12 weeks.

Physical and chemical characterize of (CBECTR).

Temperature daily was determined, Solid – liquid extract were done then pH was determined, Electric conductivity (E.C.), total dissolved salts (TDS) and dissolved oxygen (DO) were measured, after 12 weeks selected samples were filtered and metals ions were assessment iron (Fe), manganese (Mn), zinc (Zn), magnesium (Mg), copper (Cu), nickel (Ni), potassium (K), lead (Pb), cobalt (Co), cadmium (Cd) and phosphorus

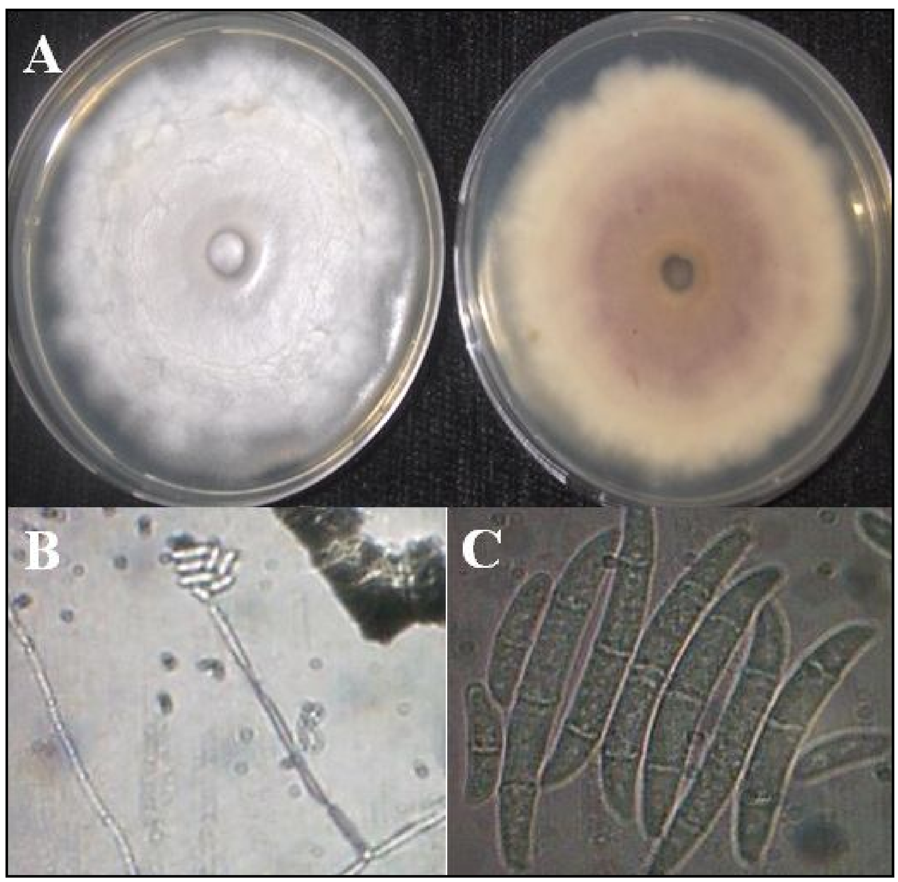

Fig. 1: (A) macro criteria of (Fs) colony (Left: front morphology, Right: reverse side of the colony. (B)conidiophore X 400. (C) micro, meso and macro – conidia X 1000.

(P) as described in Page et al. (1982). Buck Scientific INC 210– atomic absorption spectrophotometer (AAS) used to carried out analysis. Organic carbon and organic matter (OM) were determined using the Walkley-Black wet combustion method (Tan, 1996). Finally, compost total nitrogen content was determined using the micro-Kjeldahl technique (Nelson and Sommers, 1973).

Fusarium solani isolation and pathogenicity test

Four deferent isolates of *Fusarium solani* (Fs) were isolated and identified by Leslie and Summerell (2006) through field visiting of distance area of Babylon Province were representing by Fs1, Fs2, Fs3 and Fs4, maintained on potato dextrose agar (PDA) plats.

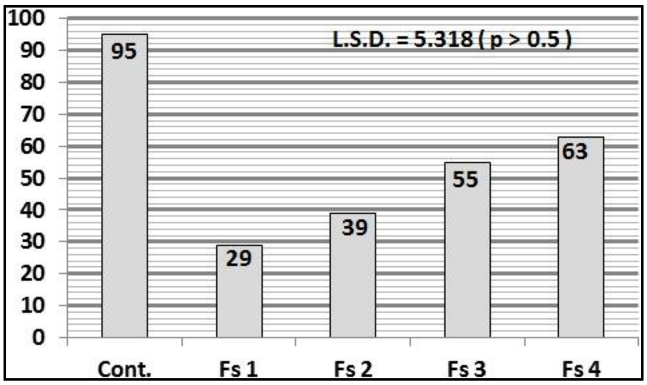

Fig. 2: effect the spores suspension 1X10 ^{7} of (Fs) isolates in cucumber seeds germination ratio (%) in Blotter paper technique.

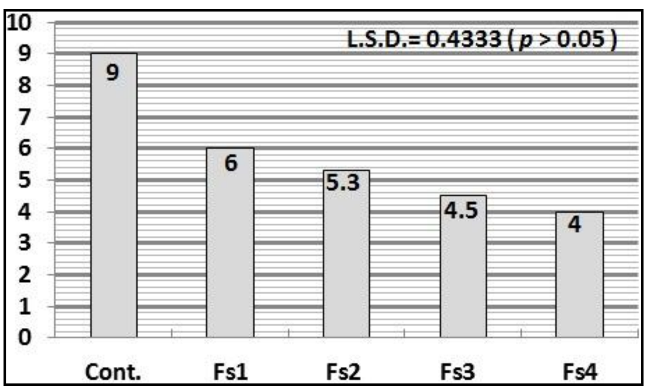

Fig. 3: Effect of 10 % extract of (CBECTR) amendment to PDA media on radial mycelium growth (cm) of (FS).

Pathogenicity were tested by preparing 1 × 10^7 of each isolates separately and treated sterilized cucumber seeds (*cv.* Alpha – beta) using Blotting papers technique (ISTA 2018) in four replication.

Inhibition growth of (Fs) by extracting (CBECTR)

Compost extracted by mixing with tap water 1:2 ratio (v:v) in 25°C for 48 h, then the mixture passed through cloth cheesecloth and the extracts were sterilized by autoclaving (Bernal-Vicente *et al*., 2008).

PDA media were prepared with a low water content. 10% of extract was amendment and the volume was completed, while control treatment was prepared without extracted CBECTR (Salemv *et al.,* 2012). 0.5 cm discs had been taken from fresh colonies of (Fs) isolates and inoculated in center of 9cm petri dishes which are previously poured with prepared media, then all plats were incubated at 28°C for 7 d and then diameter of colonies were measured in four replicate for each treatment.

Field experiment:

Field experiment conducted in plastic house. Plastic bags were used to conducted this experiment, after being punched with many holes, their were two major group. Group A. the soil were amendment with 10% of (CBECTR). Group B. the soil had no (CBECTR) amendment, both the two groups inoculated with 1% of each (Fs) isolates separately all treatment were put in a holes in the soil and irrigated with dropping systems. Each plastic bag filled with 10 Kg of soil, while control treatment filled with soil only, the plastic bags with four replicates were sowed by 10 seeds of cucumber cv. alpha – beta, a week later seeds germination were calculated and a month later all plants were collected and the incidence of root rot and dry weight of plants were measured.

Statistical analysis

All data of experiments were analyzed using least significant differences test (LSD) by analysis of variance by (GenStat) discovery edition 12.1.0.3278. 2012. software (Charities and educational Institute, UK) to compare the means of every treatment against the control and simultaneously establish their significance ($P < 0.05$).

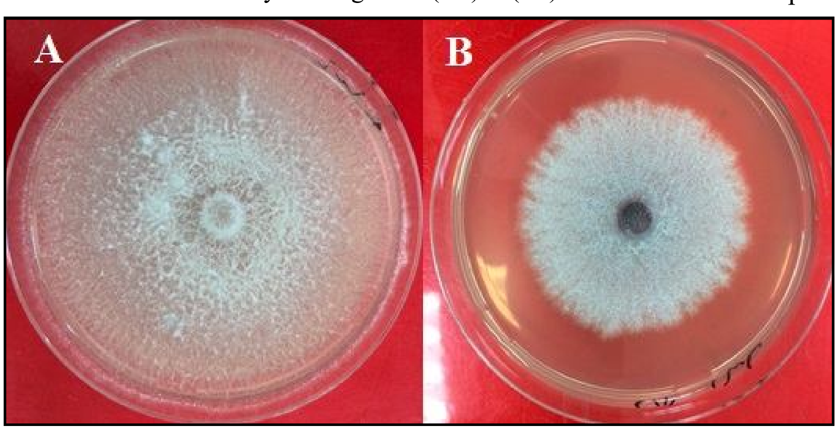

Fig. 4: Effect 10% of (CBECTR) on radial growth of (Fs1) isolates cm.(A) Control treatment. (B) Amendment treatment.

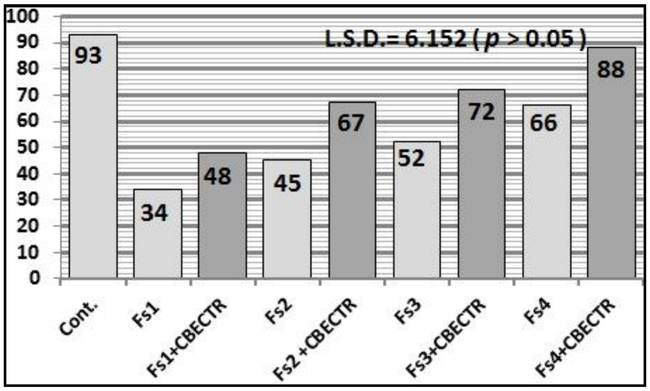

Fig. 5: Effect of pathogenic isolates of fungus (Fs) inoculated in soil with or without 10 % (CBETCR) on germination % of cucumber seeds in which they seeding in this soil.

Results

Physical and chemical characterize of (CBECTR)

Table 1. revealed to the major of the physical and chemical characterization of (CBECTR) after 12 weeks of composting processing.

Identification of fungus isolation

Identification studies of isolates by light microscope and according Leslie and Summerell (2006), all are referred to *Fuasrium solani* Fig. 1.

(Fs) has wide speared in all over the world and can cause root rot for several plant crops (Leslie and Summerell, 2006).

(Fs) pathogenicity test on seeds germination ratio.

Inhibition of seeds tested germination of cucumber plant were significantly observed by spores suspension 1×10^7 of (Fs) isolates in Blotting papers technique (Fig. 2). All (Fs) isolates caused decrease of viability of germinated seeds.

Table 2: Effect of pathogenic isolates of fungus (Fs) that inoculated in soil with or without 10 % (CBETCR) on % incidence of root rot and dry weight of cucumber seeds in which they seeding in this soil.

Treat.	Root Rot Incidence	Dry weight
Fs 1	53	1.25
Fs 1+ CBECTR	32	2.10
Fs 2	48	1.45
Fs 2+ CBECTR	30	2.35
Fs 3	44	1.55
Fs 3+ CBECTR	29	2.55
Fs 4	42	1.60
Fs 4+ CBECTR	24	2.65
Cont.	0	2.85
L.S.D ($p > 0.05$)	5.479	0.5811

Each number represent four replicate

As showed in Fig. 1. (Fs1) has higher incidence in seeds germination ratio inhibition then (Fs2) while (Fs4) occupied the last place. (Fs) isolates marked a satisfaction levels of pathogenicity according to the mechanisms of their genetic reformation.

Inhibition growth of (Fs) by extracting (CBECTR).

(Fs) radial mycelium growth were significantly affected by 10% extracts of (CBECTR) measured by (cm), ANOVA F pr. < 0.001 (Fig. 3).

The highest decreasing in radial mycelium growth

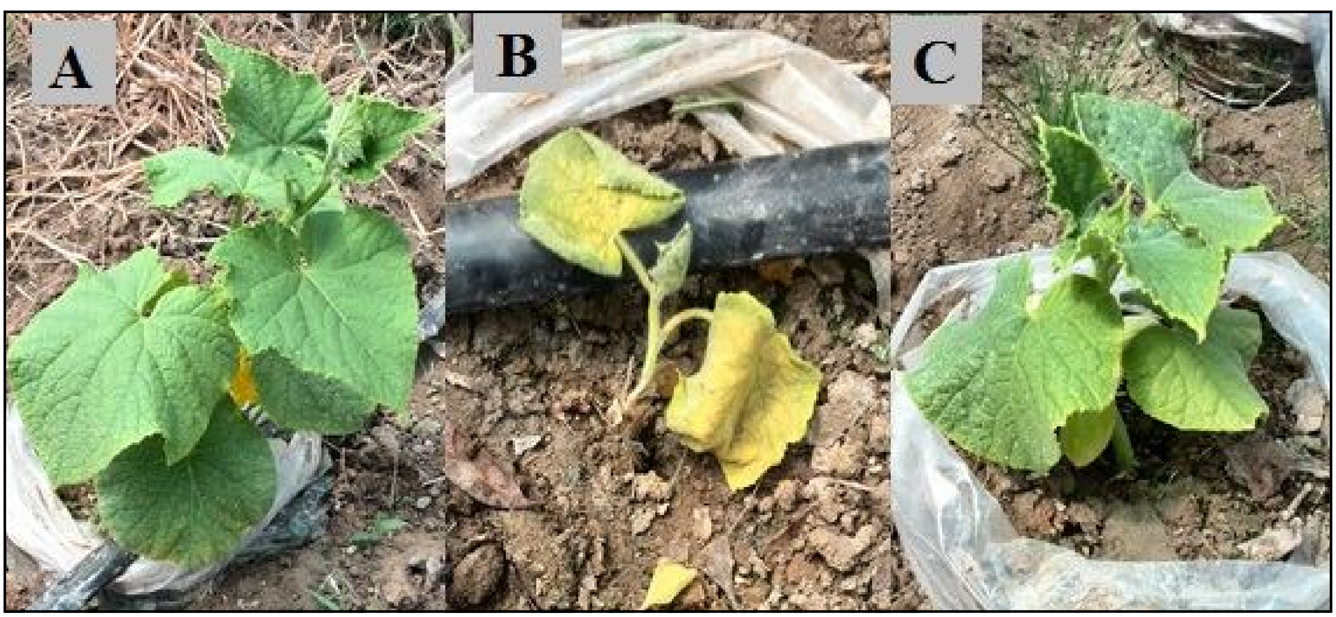

Fig. 6: incidence of root rot causing by (Fs1), role of (CBECTR) to suppression disease in cucumber plants. A) Control. B) Root rot causing by (Fs1). C) Effect of 10 % (CBECTR) in reducing disease incidence.

was showed in isolate (Fs4) while (Fs1) was the less affecting by 10 % extracted CBECTR (Fig. 4).

Field experiment:

Results of field experiment shown in (Fig. 5). clearly revealed, that all pathogenic isolates Fungus (Fs) were significantly affected on seeds germination ratio.

Data of field experiment are confirmed to previous laboratory tests, (Fs1) has the higher effect of root rot incidence followed by (Fs2), while (Fs4) was the lowest pathogenic isolate (Table 2).

Results clearly revealed to significant impact of 10 % (CBECTR) in reducing root rot disease incidence (ANOVA Pr < 0.001) for all (Fs) isolates had tasted in this experiment. In addition, 10% (CBECTR) has influence cucumber plants growth in spite of pathogenic isolates of (Fs) Fig. 6.

Discussion

This paper is concern by convert the huge mass of plant trees from harmful of material of agriculture sector which are secreting a deferent allelopathic compounds that can be causes transformation of the affected plants (Awadallah and Iman 2019), to be able to be analyzed biologically to produce high quality of natural compost can improve the plant growth and provide it with all the elements with all necessary nutrition elements (Nagar *et al.,* 2017). Biological degradation to the biomass of plant residue processing, although it takes a relatively long time, it is, the most effective among all other methods, cutting out complex technology because of safety and affective and cheap (Sinegani *et al.,* 2005).

Fusarium solani is one of the most soil borne fungi has varied creatures is that it caused a lot of confusion to the scientists involved in this fungus (Leslie and Summerell. 2006). There are many plant families that can infect them and cause mold symptoms. (Romberg and Davis 2007). His isolate are varied in their won virulence the isolates of this fungus has varied in their virulence, as it ranges from the non-pathogenic and then the low pathogenic incidence to the highly pathogenic, due to the pathogens that are armed with it and that are governed by the genetic makeup of each of them. (Ondøej *et al.,* 2008).

Compost ability to suppressing fungi disease to agriculture crops had been known since a long time ago (Jeanine *et al.,* 2002). chemical aspect had been postulated lick secretion antibiotic by beneficial microorganisms or activation of genes of disease resistance in plants (Hoitink and Boehm, 1999). In addition to the aforementioned, the organic matter contains microorganisms that play a role in competing with *Fusarium* root rot and suppression the disease incidence. This study confirm with Salem *et al.,* (2012) in the possibility of employing composted plant residue to undermine the impact of soil diseases, especially *Fusarium* root rot.

These results are agreement with Estrella *et al.,* (2012) of significant inhibition of mycelium development of *Fusarium oxysporum* f. sp. *melonis* by using compost of agriculture product in agar plates in laboratory condition.

Our results indicate that the (CBECTR) have strong suppressive to Fusarium root rot of cucumber plants in pots experiments, these results are confirms with Vibha and Nidhi (2014), thus, it can be concluded that the *Eucalyptus camaldulensis* bio mass residue can be converted from harmful waste to an important resource of agriculture input and effective technique to suppressive disease that caused by soil borne fungi like *Fusarium solani*, which is in line with the concept of sustainable development and environmentally friendly technologies.

Conclusion

The results of this paper are clearly revealed that isolates of *Fusarium solani* are a serious threat to the production of cucumbers in Babylon Province, Iraq. It is easy to converted the biomass of green residue of *Eucalyptus camaldulensis* from accumulated substance that cause environmental damage to high quality inputs in agricultural production. The composting biomass of *Eucalyptus camaldulensis* residue (CBECTR) clearly improves the physical and chemical properties of agricultural soils. The composting biomass of *Eucalyptus camaldulensis* residue (CBECTR) significantly are able to suppress the pathogenicity of soil pathogens as *Fusarium solani*.

References

Awadallah, B. Dafaallah and Iman O. EL-Towm (2019). Phytotoxic Effects of *Eucalyptus camaldulensis* Dehnh Leaves Aqueous Extracts on Seed Germination of some Cereal Crops using Probit Analysis. *International Journal of Academic Multidisciplinary Research (IJAMR),* **3(7):** Pp: 18-23.

Estrella, S.F., M.A. Bustamante, R. Moral, M.C. Vargas-García1, M.J. López and J. Moreno (2012). *In Vitro* Control Of Fusarium Wilt Using Agro industrial Sub product-Based Compost. *Journal of Plant Pathology,* **94(1):** 59-70.

FAO (1979). Food and Agriculture Organization Of united Nation. Eucalyptus for planting. P: 745. ISBN. 92–5 -100570-2. Roma.

Ferguson, J.J. and B. Rathinasabapathi (2003). Allelopathy :

How plants suppress other plants. HS944 series Institute of food and agricultural sciences, University of Florida, online publication; http://edis.ifas.ufl.edu.

Fuchs, J.G. (2002). Practical use of quality compost for plant health and vitality improvement. In : Microbiol. Composting, by Klammer S (Ed.). Berlin Heiselberg: Springer-Verlag. pp. 435-444.

Habib, R.H., S.M. Awadh and M.Z. Muslim (2012). Toxic heavy metals in soil and some plants in Baghdad, *Iraq, Journal of Al-Nahrain University, science,* **15(2):** pp. 1-16.

Hoitink, H.A.J. and M.J. Boehm (1999). Biocontrol within the context of soil microbial communities : a substrate-dependent phenomenon. *Annu. Rev. Phytopathol.,* **37:** 427-446.

I.S.T.A. Seedling Evaluation Handbook 4th Edition.9 (2018). **47:** Pp.157. Online and open access: www.seedtest.org.

Janan, A. Saeed Eman R. Al-Rawi Fatin K. Ibraheem (2013). The Effect of Aqueous Leaves Extracts of *Eucalyptus camaldulensis* on Germination and Growth of Three Weed Species Raf. *J. Sci.,* **24(2):** pp. 1-10.

Jeanine, I.B., J.B. Greg and T.T. Jack (2002). Assessment of compost for suppression of *Fusarium* patch (*Microdochium nivale*) and Typhula blight (*Typhula ishikariensis)* snow molds of turfgrass Biol. *Control.,* **25:** 162-172.

Lazcano, C., M. Gómez-Brandón and J. Domínguez (2008). Comparison of the effectiveness of composting and vermicomposting for the biological stabilization of cattle manure. *Chemosphere*, **72:** 1013-1019.

Leslie John F. and A. Summerell Brett (2006). The Fusarium Laboratory Manual. Blackwell Publishing Professional 2121 State Avenue, Ames, Iowa 50014, USA. Pp. 387.

Merjan, A.F. and AL- Janabi (2015). Molecular identification of *Fusarium oxysporum* f. sp. *lycopersici* isolates and suppression mechanism to growth, reproduction and genome content using debris of tomato plants. Ph. D thesis. Kufa University. P. 213.

Nagar, R., T. Anurag and P. Bhati (2017). Vermicomposting of green Eucalyptus leaf litter by *Eisenia foetida* and *Eudrilus Eugenia*. *International Journal of Environment, Agriculture and Biotechnology, (IJEAB),* **2(6):** Pp: 2811-2900.

Nelson, D.W. and L.E. Sommers (1973). Determination of total nitrogen in plant material. *J. Agronom.,* **65:** 109-112.

Ondøej, M., Radmila Dostálová and Rudolf Trojan (2008). Evaluation of Virulence of *Fusarium solani* Isolates on Pea. *Plant Protect. Sci.,* **44(1):** 9–18.

Page, A.L., F.H. Miller and D.R. Keeney (1982). Methods of soil analysis, Part 2, Chemical and Microbiological Properties, Agronomy, 2nd edition, Madison.

Romberg, M.K. and R.M. (2007). Host Range and Phylogeny of *Fusarium solani* f. sp. *Eumartii* from Potato and Tomato in California. *Plant Dis.,* **91:** 585-592.

Salem, M.M., W.F. Sayed, H. Abdel-Fatah and H.H. Neamat (2012). Assessment of compost for suppression of *Fusarium oxysporum* and improving *Zea mays and Hibiscus sabdarriffa* resistance to wilt diseases. *African Journal of Biotechnology,* **11(69):** pp. 13403-13414.

Sinegani, A.A., G. Emtiazi, S. Hajrasuliha and Shariatmadari (2005). Biodegradation of some agricultural residues by fungi in agitated submerged cultures. *African Journal of Biotechnology,* **4(10):** pp. 1058-1061.

Tahir, J.F. (2011). Weeds control in forest ecosystem by the allelopathic potential of (*Eucalyptus camaldulensis*). Msc. thesis, Coll. of Agric., Duhok Univ. Duhok. Iraq.

Tan, K.H. (1996). Soil Sampling, Preparation and Analysis. Marcel Dekker, Inc., New York, NY.

Tilman, D., K.G. Cassman, P.A. Matson, R. Naylor and S. Polasky (2002). Agricultural sustainability and intensive production practices. *Nature*, **418:** 671-677.