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


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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).

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
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).

Results referred to the high quality of (CBECTR).

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

<table>
<thead>
<tr>
<th>Character</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.35</td>
</tr>
<tr>
<td>EC mS/cm</td>
<td>1.23</td>
</tr>
<tr>
<td>OM %</td>
<td>87.6</td>
</tr>
<tr>
<td>TDS mg/l</td>
<td>25.95</td>
</tr>
<tr>
<td>DO μs</td>
<td>25</td>
</tr>
<tr>
<td>Fe mg Kg⁻¹</td>
<td>1.8</td>
</tr>
<tr>
<td>Mn mg Kg⁻¹</td>
<td>4.09</td>
</tr>
<tr>
<td>Zn mg Kg⁻¹</td>
<td>5.8</td>
</tr>
<tr>
<td>Mg mg Kg⁻¹</td>
<td>3.466</td>
</tr>
<tr>
<td>Cu mg Kg⁻¹</td>
<td>7.81</td>
</tr>
<tr>
<td>Ni mg Kg⁻¹</td>
<td>1.17</td>
</tr>
<tr>
<td>Pb mg Kg⁻¹</td>
<td>0</td>
</tr>
<tr>
<td>N mg Kg⁻¹</td>
<td>0.139</td>
</tr>
<tr>
<td>P mg Kg⁻¹</td>
<td>0.571</td>
</tr>
<tr>
<td>K mg Kg⁻¹</td>
<td>0.39</td>
</tr>
</tbody>
</table>

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 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.

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.
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.

Pathogenicity were tested by preparing $1 \times 10^7$ 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 $25\degree C$ 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 $28\degree C$ 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 ($P < 0.05$).
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 *Fusarium 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.

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

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

<table>
<thead>
<tr>
<th>Treat.</th>
<th>Root Rot Incidence</th>
<th>Dry weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fs 1</td>
<td>53</td>
<td>1.25</td>
</tr>
<tr>
<td>Fs 1+ CBECTR</td>
<td>32</td>
<td>2.10</td>
</tr>
<tr>
<td>Fs 2</td>
<td>48</td>
<td>1.45</td>
</tr>
<tr>
<td>Fs 2+ CBECTR</td>
<td>30</td>
<td>2.35</td>
</tr>
<tr>
<td>Fs 3</td>
<td>44</td>
<td>1.55</td>
</tr>
<tr>
<td>Fs 3+ CBECTR</td>
<td>29</td>
<td>2.55</td>
</tr>
<tr>
<td>Fs 4</td>
<td>42</td>
<td>1.60</td>
</tr>
<tr>
<td>Fs 4+ CBECTR</td>
<td>24</td>
<td>2.65</td>
</tr>
<tr>
<td>Cont.</td>
<td>0</td>
<td>2.85</td>
</tr>
<tr>
<td>L.S.D (p &gt; 0.05)</td>
<td>5.479</td>
<td>0.5811</td>
</tr>
</tbody>
</table>

Each number represent four replicate

1×10^7 of (Fs) isolates in Blotting papers technique (Fig. 2). All (Fs) isolates caused decrease of viability of germinated seeds.
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 Summerrell. 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.

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