Role of Nanotechnology in Plant Protection

DR. ALAA Y GHIDAN
ASSISTYANT PROFESSOR OF NANOTECHNOLOGY
What is Nanotechnology???
TEM Vs SEM

TEM images

Vs

SEM images
Nano-agrotechnology

- Soil Management
- Nano-sensors
- Nano-fertilizers
- Nano-pesticides
- Nano-herbicides
- Nano-fungicides
- Water management
Application of Nanotechnology in Plant Protection

Better Crop Growth: Nanotechnology helps deliver fertilizers and pesticides precisely to crops, making them grow better and resist pests.
Application of Nanotechnology in Plant Protection
Application of Nanotechnology in Plant Protection

Using Nutrients Efficiently:
Nanotechnology ensures plants absorb nutrients effectively, reducing waste and helping crops grow healthier.
Application of Nanotechnology in Plant Protection

**Smart Farming: Tiny** sensors monitor soil and crop health, helping farmers use water and chemicals just where they’re needed.

**Spotting Problems Early:** Nano sensors can find plant diseases early, so farmers can fix them before they spread.
Application of Nanotechnology in Plant Protection

Current monitoring protocols:
- HPLC
- Gas Chromatography
- Calorimetry assay
- Mass Spec.

No practical application at ground level.

- Time consuming
- Expensive
- Need skilled labour
- Sophisticated machinery

Loss for late result
- Not affordable
- Need proper training
- Need care of machine

Solution: Nano-sensor
- Real time detection
- Cheap cost
- No need of trained labour
- Easy to handle

Real time field data
Application of Nanotechnology in Plant Protection

Nano sensors used to diagnose disease caused by infecting soil microorganisms, such as viruses, bacteria, and fungi via the quantitative measurement of differential oxygen consumption in the respiration (relative activity) of good microbes and bad microbes in the soil. (Rai et al., 2012).
Application of Nanotechnology in Plant Protection

Nanotechnology drones, with their compact size, advanced sensors, and nanomaterial-integrated components, redefine data collection, reconnaissance, and surveillance in agriculture, security, and environmental studies.
Application of Nanotechnology in Plant Protection

Cleaning up Soil: Nanomaterials clean soil by removing harmful chemicals, making it better for growing crops.

Safer Pest Control: Nanotechnology creates barriers that keep pests away without harmful chemicals.

Saving Water: Nanotech filters clean water for crops, saving water and keeping them healthy.
Improving Plant Traits: Nanotechnology helps scientists change plant genes to make them better at surviving droughts or diseases.
Application of Nanotechnology in Plant Protection

Keeping Food Fresh: Nanotech packaging makes food last longer, reducing waste and keeping it safe to eat.
Examples of nanoparticles in Plant protection

Protecting the Environment: By using less water and fewer chemicals, nanotechnology helps farming without harming the environment.
COMPARISON OF DIFFERENT GREEN SYNTHESIZED NANOMATERIALS ON GREEN PEACH APHID AS APHICIDAL POTENTIAL

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### TABLE 2
Mortality means for the different tested nanomaterials on early nymphal instars of *M. persicae* after 24 hours treatment.

<table>
<thead>
<tr>
<th>Nanomaterials</th>
<th>Slope</th>
<th>LC50* (PPM)</th>
<th>95%CL***</th>
<th>LC50** (PPM)</th>
<th>Chi-Square</th>
<th>Pr&gt; Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>CuONPs</td>
<td>2.7</td>
<td>0.15*</td>
<td>0.03 - 0.24</td>
<td>0.89*</td>
<td>33.31</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>ZnONPs</td>
<td>1.24</td>
<td>0.42*</td>
<td>0.04 - 0.51</td>
<td>2.11*</td>
<td>3.76</td>
<td>0.050</td>
</tr>
<tr>
<td>MgHNP4s</td>
<td>2.73</td>
<td>0.15*</td>
<td>0.03 - 0.24</td>
<td>0.89*</td>
<td>50.03</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>MgONPs</td>
<td>0.54</td>
<td>1.24*</td>
<td>0.06 - 2.01</td>
<td>2.82*</td>
<td>0.98</td>
<td>0.320</td>
</tr>
</tbody>
</table>

*LC50 values sharing the same letters do not differ significantly (95% of CL are not overlapping).
**LC50 values sharing the same letters do not differ significantly (95% of CL are not overlapping).
***CL confidence limits

### TABLE 3
Mortality data for the different nanomaterials on late nymphal instars of *M. persicae* after 24 hours treatment.

<table>
<thead>
<tr>
<th>Nanomaterials</th>
<th>Slope</th>
<th>LC50* (PPM)</th>
<th>95%CL***</th>
<th>LC50** (PPM)</th>
<th>Chi-Square</th>
<th>Pr&gt; Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>CuONPs</td>
<td>5.15</td>
<td>0.29*</td>
<td>0.17 - 0.45</td>
<td>0.71</td>
<td>16.28</td>
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<td>ZnONPs</td>
<td>1.67</td>
<td>0.58*</td>
<td>0.36 - 1.83</td>
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<td>MgHNP4s</td>
<td>0.41</td>
<td>0.95*</td>
<td>0.39 - 1.84</td>
<td>6.25</td>
<td>0.73</td>
<td>0.3900</td>
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<tr>
<td>MgONPs</td>
<td>2.29</td>
<td>0.19*</td>
<td>0.04 - 0.35</td>
<td>1.15</td>
<td>13.34</td>
<td>0.0003</td>
</tr>
</tbody>
</table>

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**LC50 values sharing the same letters do not differ significantly (95% of CL are not overlapping).
***CL confidence limits

### TABLE 4
Mortality data for the different nanomaterials on early nymphal instars of *M. persicae* after 48 hours treatment.

<table>
<thead>
<tr>
<th>Nanomaterials</th>
<th>Slope</th>
<th>LC50* (PPM)</th>
<th>95%CL***</th>
<th>LC50** (PPM)</th>
<th>Chi-Square</th>
<th>Pr&gt; Chi-Square</th>
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</thead>
<tbody>
<tr>
<td>CuONPs</td>
<td>3.19</td>
<td>0.02*</td>
<td>0.18 - 0.49</td>
<td>0.71*</td>
<td>10.160</td>
<td>0.0014</td>
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<td>ZnONPs</td>
<td>1.39</td>
<td>0.53*</td>
<td>0.21 - 0.96</td>
<td>1.05*</td>
<td>0.950</td>
<td>0.33</td>
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<tr>
<td>MgHNP4s</td>
<td>0.00</td>
<td>0.53*</td>
<td>0.20 - 0.97</td>
<td>1.05*</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>MgONPs</td>
<td>2.85</td>
<td>0.02*</td>
<td>0.14 - 0.65</td>
<td>0.75*</td>
<td>9.680</td>
<td>0.0019</td>
</tr>
</tbody>
</table>

*LC50 values sharing the same letters do not differ significantly (95% of CL are not overlapping).
**LC50 values sharing the same letters do not differ significantly (95% of CL are not overlapping).
***CL confidence limits.
APHIDICIDAL POTENTIAL OF GREEN SYNTHESIZED MAGNESIUM HYDROXIDE NANOPARTICLES USING Olea europaea LEAVES EXTRACT

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ABSTRACT
Magnesium hydroxide (MgHNPs) nanoparticles were synthesized using Olea europaea aqueous extract at ambient temperature and in one-single step. X-ray diffraction (XRD) analysis showed that synthesized MgHNPs have spherical shape with an average size diameter 40nm. Fourier transform infrared (FT-IR), scanning electron microscopy (SEM) and UV-vis spectrophotometer were used to characterize the synthesized magnesium hydroxide nanoparticles. This study determined the mortality efficacy of different concentrations of the synthesized MgHNPs against early and late nymphal instars of the green peach aphid. There were significant differences in the aphid mortalities between the different concentrations of the MgHNPs nanoparticles. In addition, the differences between the different concentrations and the control were significantly obvious.

Keywords: green synthesis, magnesium hydroxide nanoparticles, Olea europaea leaf extract, mortality, green peach aphid.
Green synthesis, characterization and antibacterial activity of silver nanoparticles by *Malus domestica* and its cytotoxic effect on (MCF-7) cell line

Mariadoss Arokia Vijaya Anand, Ramachandran Vinayagam, Shalini Vijayakumar, Agilan Balupillai, Franklin Jebbaraj Herbert, Sanjay Kumar, Alaa Y. Ghidan, Towfiq M. Al-Antary, Ernest David
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Introduction

Nanotechnology, with eco-friendly methods and working now as nanopesticides, nanofertilizers, nano antimicrobial activity and nano anticancer.

Ernest David's Lab

Current institution

University of Jordan
Department of Biological Sciences

Current position
Assistant Professor of Nanotechnology and Microbiology
Thank you