PHYSIOLOGICAL AND ANATOMICAL STUDIES ON THE EFFECT OF GAMMA AND LASER IRRADIATION AND SOME BIOREGULATORS TREATMENTS ON THE GROWTH, FLOWERING AND KEEPING QUALITY OF GERBERA

BY

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A thesis submitted in partial fulfillment of the requirements for the degree of

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INTRODUCTION

*Gerbera jamesonii* flowers is one of the most important cut flowers, it is very attractive flower, grown through the world in wide range of climate conditions, which is ideal for bed, border, pots and for rock garden, and highly recommended for exportation. This plant belongs to the family compositae (Asteraceae) which is the largest family of flowering plants, some are food plants and others are drug plants and many are ornamental plants. The later plants is considered one of the very promising plants that have an economic important for exportation to obtain a suitable income. From the ornamental plants of view gerbera is urgently needed extensive efforts to increase the productivity and improving the product quality of this economic plant. Improving growth, flower yield quality and plant constituents by using plant growth promoting such as steroid compounds, rays of gamma and laser have attained much interest at different parts of world. As for steroid compounds, progesterone acts as a mammalian gonadal hormone, it is essential for continuation of early pregnancy and play important role in ovulation. Progesterone has also been reported to be present in *Holarrhena floribunda* leaves (Leboeuf et al. 1964), apple seeds (Gawienowski and Gibbs, 1968) and in pea (*Pisum sativum*) Lino et al. (2007). The effect of progesterone in inducing flowering or generation development in wheat was recorded by (Janeczko and Filek, 2002) and arabidopsis Janeczko et al. (2003). As for Gamma rays belongs to ionizing
radiation and interact to atoms or molecules to produce free radicals in cells. These radicals can damage or modify important components of plant cells and have been reported to affect differentially the morphology, anatomy, biochemistry, and physiology of plants depending on the irradiation level. These effects include changes in the plant cellular structure and metabolism, e.g., dilation of thylakoid membranes, alteration in photosynthesis, modulation of the antioxidative system, and accumulation of phenolic compounds (Kim et al., 2004, Kovacs and Kereszies, 2002 and Wi et al., 2005). As for laser rays belong to unionizing radiation laser is an abbreviation of Light Amplification by Stimulated Emission of Radiation. It is identified by the emitted wavelength and the power.

Properties of laser light

Laser radiation is different from all natural forms of light beams in three ways:

1. It is a coherent beam.
2. Nearly collimated.
3. Monochromatic.

-Types of Lasers :-

Solid state laser (ND YAG, Diode laser, Ruby)
Gas lasers (CO₂, N, He-Ne, Ar)
Dye lasers (cumarin)

1-Helium Neon laser (He-Ne):-
The Helium Neon laser is the most familiar and least expensive gas laser. It emits a fraction of milliwatt to tens of milliwatts (mW) of red light at 632.8 nanometers (nm), As such; it has long been the most common and most economical visible laser. The active medium in a helium Neon laser is a mixture of helium and neon gases at a total pressure of a fraction of a torr to several torrs.

**Typical He – Ne laser parameters:**

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<td>Pumping Method</td>
<td>Electric discharge</td>
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<tr>
<td>Mode of operation</td>
<td>CW</td>
</tr>
<tr>
<td>Output power</td>
<td>0.5 mW to 100 mW</td>
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**2- Argon ion laser (Ar):**

The argon ion laser is one of a class of noble gas ion lasers that operate in the visible and ultraviolet spectral regions. The argon ion laser can provide approximately 25 visible wavelengths ranging from 408.9 to 686.1 nm and more than 10 ultraviolet wavelengths ranging from 275 to 363.8 nm.

In the visible spectral region, CW powers of up to 100 W are available with the output concentrated on a few strong lines (including the 488 nm and 514.5 nm transition). Argon ion laser operate in high temperature plasma tubes with a bore diameter of 1-2 mm and lengths ranging from 0.1 m to approximately 1.8m.

- **Typical argon ion laser parameters:**
### Laser Wavelengths

<table>
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</tr>
<tr>
<td>Output power</td>
<td>10 mW to 50 W</td>
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- **Laser tissue interaction**

*Absten (1992)* reported that "the nature of the interaction between laser light and biological tissue can be described in terms of reflection, scattering, transmission and absorption.

![Geometry of reflection, absorption and scattering.](image)

In order for light to exert its effect upon tissue, it has to be absorbed. If it is reflected from or transmitted through the tissue, no effect will occur. If the light is scattered it will be absorbed over a large area, so that its effects will be more diffusive. The effects of laser on biological tissue may be thermal, non-thermal and within each category there are two main modes of action.
1- Thermal processes

Carruth (1987) reported that when tissue absorbs laser energy, the temperature rises. No changes in tissue structure are evident between 37°C and 60°C, however, above that temperature, tissue begins to coagulate.

a- Coagulation

Berns et al. (1992) and Pick (1993) reported that the temperature rise in an irradiated tissue is proportional to light absorption in that tissue which in turn is determined by how effectively its constituent molecules absorb incident photons of a particular wavelength.

b- Vaporization

El-Adely (1997) reported that when laser energy is higher than those required for photo-coagulation, tissue temperature can reach the boiling point of water and rapidly expanding water vapour will cause disruption "photovaporization" before denaturation can cauterize the tissue.

2- Non thermal Processes:

a- photochemical effect:

A direct interaction between laser photons and molecules is responsible for "photochemical" effect (Jeff, 1992).

The aim of this investigation to throw more light on growth, flowering and anatomical structure of gerbera plants by using irradiation with gamma, laser, and progesterone either single or in combination.