Comparative study of allelopathic effects of *Mirabilis jalapa* L. leaves extracts on biochemical contents of dicot and monocot plant

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Abstract- Secondary metabolites produced by different plants might inhibit or stimulate the growth and development of other plants present in their vicinity. *Mirabilis jalapa* leaves extracts were tested for their effect on the biochemical content of a dicot plant *Vigna radiata* L(Mung) and a monocot plant *Eleusine coracana L.* (Ragi) and to observe their allelopathic potential. It was observed that 6% & 8% concentrations of the extract showed a stimulatory effect on its biochemical contents such as protein, carbohydrates. Monocot plant is more vulnerable to allelopathy than dicot plant.

k*eywords:* Allelopathy, leaf extract, *Mirabilis jalapa, Vigna radiata, Eleusine coracana,* biochemical.

INTRODUCTION

In nature, plants species grow together and interact with each other by inhibiting or stimulating the growth and development through different interactions. A special form of competition among plants is known as Allelopathy. The term Allelopathy was introduced by an Austrian scientist Hans Molisch in 1937, which means the injurious effect of one plant upon the other. However, in 1996, the International Allelopathy Society defined allelopathy as "Any process involving secondary metabolites produced by plants, that influence the growth and development of plants. "Biochemical inhibition" theory of de Candolle (1832) was confirmed in 1937 by Molisch, who introduced the term scientific of "Allelopathy", referring to the "biochemical dialogue" between organisms (Ramona Ştef *et al*, 2015)

Allelopathic interactions are primarily based on the synthesis and release of secondary metabolites by higher plants that initiate a wide array of biochemical reactions, which induce several biological changes (Sumatra Nath *et al*, 2016) Allelopathic chemicals can be present in any part of the plant. They can also be found in the surrounding soil.

Allelopathy is believed to be involved in many natural and manipulated ecosystems and it plays an important role in the evolution of plant communities, exotic plants invasion and replant failure (Sunday Arowosegbe *et al*, 2012). Many plant species including medicinal plants are able to produce and release bioactive compounds which are secondary metabolites into the environment and are capable of suppressing the growth of other plants. Such chemicals include tannins, phenol acids, lignin, alkaloids, flavonoids, coumarins and terpenoids.
The toxic chemicals may interfere with germination of seeds, inhibit shoot or/and root growth; they may inhibit nutrient uptake, or they may attack a naturally occurring symbiotic relationship thereby destroying the plant's valuable source of a nutrient. Leaf extract had the strongest allelopathic effect on seed germination (Seerjana Maharjan *et al*, 2007).

Mirabilis jalapa is popularly known as four o clock. It belongs to the family Nyctaginaceae. It is a large, herbaceous plant grown in gardens throughout India and Pakistan. *Mirabilis jalapa* L. exhibits certain useful activities like antiviral, antimicrobial, antifungal, anti-corrosion. (Rozina Rozina, 2016). The plant is widely used as traditional medicine in many parts of the world. As the secondary metabolites produced by one plant may induce several biological changes in other plants in view of this a study has been carried out to compare the effect of leaf extract of *Mirabilis jalapa* on the biochemical contents of a dicot plant *Vigna radiata* L and a monocot plant *Eleusine coracana* L.

MATERIALS & METHODS

Collection of Plant Materials:
The plant material is collected from the botanical garden of the college campus in the early morning. The leaves are washed with water and allowed to dry in shed. The dried leaves were powdered and 10 gms of it was taken to prepared a stock solution. which was dissolved in 100ml of distilled water.

Germination of seeds:
The experiment was conducted by preparing a series of solution with different strengths. Surface sterilizing seeds were allowed to grow in different concentrations of leaf extract. The Petri-dishes were maintained under laboratory conditions (room temperature 25°C at mid-day, and diffused light during day) for one week. After one week, the phytochemicals are analyzed.

Preparation of plant extract for phytochemical analysis:
Plant extracts were prepared with water and methanol
The obtained extracts were kept in sterile sample tubes and stored in a refrigerator at 4°C
Preliminary phytochemical screening along with qualitative and quantitative analysis of *Mirabilis jalapa* leaves extract was performed for alkaloids, tanins, saponin, flavonoids and phenols Standard tests were performed for biochemical analysis. Estimation of protein by Lowry's Method, carbohydrates by Anthrone reagent test and chlorophyll by calorimetric method of *Eleusine coracana* (Ragi) and *Vigna radiata* (Mung) was carried out.

RESULTS AND DISCUSSION

pH of the leaves extract
pH of the leaves extract of 2% to 8% show alkaline pH which range from 7.05 to 7.43. While 10% leaves extract has a slightly acidic pH i.e. 6.77.
Table No. 1. Shows presence of phytochemicals such as phenols, tannins, flavonoids in the leaf extract of Mirabilis Jalapa. Saponin was absent.

Preliminary phytochemical screening

Sr no	Phytochemical	Methanol extract of leaves	Aqueous extract of leaves
1	Tannins	Present	Present
2	Alkaloids	Present	Absent
3	Flavonoids	Present	Present
4	Phenol	Present	Present
5	Saponin	Absent	Absent

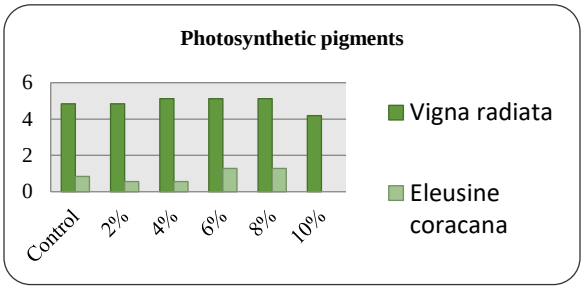
Table No. 1: Preliminary Phytochemical screening of plant extract of *Mirabilis jalapa*

Alkaloids are slightly soluble in methanol but its quantity was not measurable. Phytochemicals are more soluble in methanol as compare to water. Quantitative estimation (Table No. 2) also indicates more amount of extraction of phenols, flavonoids and tannins in methanol than in water.

Quantitative estimation of phytochemicals in leave extract

Sr No	Phytochemicals	Total amount in Methanolic extract	Total amount in watery extract
1	Phenols	38 mg of GAE / gm of sample	12.5 mg of GAE / gm of sample
2	Tannins	48 mg of CE / gm of sample	10 mg of CE / gm of sample
3	Flavonoids	51 mg of RE / gm of sample	36 mg of RE/ gm of sample

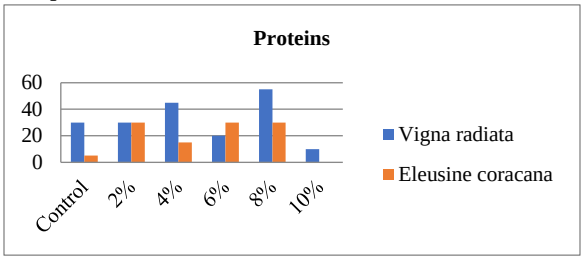
Table No.2: Phytochemical constituents of leaves extract of *Mirabilis jalapa*



Graph No.1: Effect of extract on photosynthetic pigments of *Vigna radiata* & *Eleusine coracana*

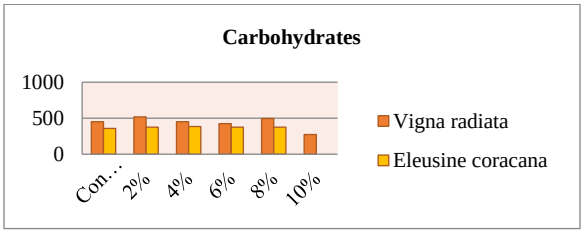
The biochemicals such as proteins, carbohydrates and chlorophyll content of the dicot plant Vigna radiata does not show much variation at lower concentration of leaf extract.10% plant extract showed a significant decrease in total chlorophyll content in both the plants(Graph No. 3). Due to influence of allelochemicals such as phenol &tannins present in the

extract of donor plant reduction in photosynthetic pigment observed. According to Sunday Arowosegbe et.al. (2012), phenol & tannins isolated from the leaves extract have been reported to inhibit the ATPase activity of plasma membrane. The gradual decreased in chlorophyll content in monocot plant may be due to inhibition in enzyme synthesis, cofactors required for chlorophyll synthesis and protein (Sunita Rao, et al ,2015). The dicot plant *Vigna radiata* found to be unsusceptible for the photosynthetic content as compare to *Eleusine coracana*.



Graph No.2 :Effect of extract on proteins content of *Vigna radiata* & *Eleusine coracana*

Proteins contents gradually decreased in dose dependent manner (Graph No. 1). At 8 % concentration of leaf extract the protein level was found to increase while at all other concentration it shows quite stable value. At 10 % concentration the monocot plant highly susceptible with no protein content in it. Seedlings has quite same concentration of sugar level at all the concentrations of leaf extract.



Graph No.3: Effect of extract on carbohydrates content of *Vigna radiata* & *Eleusine coracana*

The monocot plants are highly vernalable at 10 % concentration of leaf extract. According to (Sunita Rao, et, al 2015) allelochemicals affect plant physiological processes such as cell wall expansion, protein synthesis.

Phytochemicals such as tannins, phenols, flavonoids may exert allelopathic effects on other plants growing nearby the *Mirabilis jalapa* (Soumitra Nath, et al 2016). This is the causal factor of the growth response observed. It has been suggested that the basic plant process such as respiration, photosynthesis, protein synthesis, permeability and plant water relation may alter by allelochemicals. Among both species *Mirabilis jalapa* was found to be highly unsusceptible to monocot plant *Eleusine coracana* (Ragi) followed by *Vigna radiata* (Mung).

CONCLUSION

Leaf Extract of *Mirabilis Jalapa* has phytochemicals such as Phenol, Tannins, Flavonoids, and Alkaloids. Whereas Saponins are absent. Flavonoids are present in a larger amount as compared to Phenol and Tannins. Phytochemicals are more soluble in Methanol as compared to Water.

Monocot plants are more vulnerable to allelopathic effect as compared to dicot plants. Inhibitory effect is observed at 10 % concentration of leaf extract in the biochemical contents of both the plants may be due to slightly acidic pH.

Leaf Extract of *Mirabilis Jalapa* increases the carbohydrates and protein content of plants at 6% and 8 % concentration indicating that it can also be helpful to increase the yield of the nutritional crop. While 10 % concentration can be used as herbicide for unwanted plants.

The allelochemicals are considered to be more biodegradable than traditional herbicides. However, allelochemicals may also have undesirable effects on non-target species. Thus, necessary ecological studies are required before widespread use of allelochemicals for crop plants.

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