Influence of GA_3 on Morphological and Physiological traits of Chilli (*Capsicum annuum L*)

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Abstract: The present study investigates the effect of different concentrations of Gibberellic acid (GA_3) on the germination, growth, and biochemical composition of *Capsicum annuum* L. seeds. Seeds were treated with varying GA_3 concentrations, and parameters such as germination percentage, sprouting time, leaf characteristics, stem morphology, and biochemical contents were analyzed. The results revealed that 3 ppm GA_3 was the most effective concentration, showing the highest germination rate (70%) compared to the control (62%). GA-treated seedlings exhibited earlier sprouting, increased leaf area, darker green foliage, and elongated stems. Biochemical analysis demonstrated a significant increase in protein, carbohydrate, and DNA content, with maximum values recorded at 3 ppm GA_3, indicating enhanced metabolic activity and plant development. These findings suggest that low concentrations of GA_3 positively promote early growth and biochemical enhancement in *Capsicum annuum*. The study concludes that GA_3 is a beneficial plant growth regulator for improving seedling vigor.

Key words: Gibberellic acid, *Capsicum annuum,* biochemical contents, DNA

I. INTRODUCTION

Capsicum annuum L., commonly known as chilli pepper, is an economically important crop cultivated worldwide for its culinary, nutritional, and medicinal value. Archaeological evidence indicates that chilli peppers have been part of the human diet in the Americas since around 7500 BC, and the crop was later introduced to India by the Portuguese. Today, it forms an integral part of Asian cuisines and is widely used both as a vegetable and a spice. The fruits of *Capsicum annuum* are nutritionally rich, containing significant amounts of Vitamin C, Vitamin B6, potassium, magnesium, and iron, making them valuable for human health.

Plant growth and development are regulated by a group of naturally occurring hormones known as plant growth regulators. Among these, gibberellic acid (GA) plays a crucial role in controlling processes such as seed germination, stem elongation, leaf expansion, flowering, and fruit development. Even at micromolar concentrations, endogenous GA influences key physiological stages, particularly during flowering and fruiting. Mihaiela C et al 2020, while studying the effect of GA3 found this growth regulator enhance the seedling vigor and ornamental quality of plants while studying *Cyclamen* species (swinebread species)

To better understand the role of gibberellic acid in crop improvement, the present project investigates the effect of exogenous GA application on *Capsicum annuum*. The study focuses on evaluating how GA treatment influences seed germination, vegetative growth characteristics, and some of the biochemical contents of the plant.

II. MATERIAL AND METHODS

1. Seed Collection and Sterilization: Seeds of *Capsicum annuum* were procured from the local market. The seeds were surface-sterilized using a suitable disinfectant and rinsed thoroughly with sterile distilled water before keeping them for imbibition.

2. Preparation of GA_3 Solutions: Three different concentrations of Gibberellic acid (GA_3) were prepared:1 ppm2 ppm3 ppm, sterile distilled water served as the control (0 ppm).

3. Seed Treatment and Germination Test: Seeds were soaked in each GA_3 solution for 8 hours. The treated seeds were then transferred onto Petri plates lined with moist filter paper. Plates were incubated at 30°C for 8

hours After incubation, the number of germinated seeds was recorded to determine germination.

4. Sowing and Plant Growth: Germinated seeds were sown in soil-filled trays and maintained in the laboratory under suitable conditions for further growth. Regular watering and care were provided throughout the experimental period.

5. Measurement of Vegetative Growth and Biochemical Parameters: After 10 days, vegetative growth parameters were recorded. The seedlings were then analyzed for biochemical contents, including:

- Protein content by Lowry or Bradford method.
- Carbohydrate content Using Anthrone method.
- Chlorophyll by spectrophotometer.
- DNA content

III. RESULTS AND DISCUSSION

Protein levels increased with GA concentration. At 1 ppm, protein content was 0.21 mg/g and maximum protein content (0.32 mg/g) was recorded at 3 ppm GA_3.A considerable increase in protein content was recorded in GA-treated seedlings, with 3 ppm GA_3 showing the maximum rise. This suggests GA_3 may enhance metabolic activities and amino acid synthesis. Carbohydrate concentration was highest at 3 ppm GA_3, measuring 0.33 mg/g of plant material. This suggests improved photosynthetic activity and carbohydrate accumulation. Carbohydrate levels were higher in GA-treated plants. Increased leaf expansion and chlorophyll content in GA-treated seedlings likely contributed to enhanced carbohydrate accumulation. The maximum carbohydrate content was observed at 3 ppm GA_3. These results are in accordance with Natesh *et al* (2005) The DNA content increased with GA concentration, reaching a maximum of 0.39 mg/g at 3 ppm GA_3, indicating enhanced cell division and growth. DNA content increased progressively with GA_3 concentration.GA_3 application appears to stimulate cell division, reflected in the higher DNA levels of treated seedlings. The growth hormone with higher concentration regulates growth of the plant (Choudhury S *et al* 2014) The exogenous application of Gibberellic acid (GA_3) produced noticeable and dose-dependent effects on the growth and biochemical characteristics of *Capsicum annuum* seedlings.

IV. CONCLUSION

From the present experimental study, it can be concluded that the exogenous application of Gibberellic acid (GA_3) significantly influences the germination and growth of *Capsicum annuum* seeds. Among all the tested concentrations, 3 ppm GA_3 proved to be the most effective, resulting in the highest germination percentage and enhanced seedling growth.

The biochemical analysis further supports these findings, as the contents of proteins, carbohydrates, and DNA were noticeably higher in GA-treated plants compared to the control. This increase reflects the positive role of Gibberellic acid in promoting metabolic activities, cell division, and overall plant development. According to earlier studies (S. Singh et al., 2019), higher concentrations such as 150 ppm GA_3 also contribute to improvements in fruit size and vitamin C content, indicating the broad physiological influence of GA_3 on *Capsicum annuum*. Overall, the study establishes that lower concentrations of GA_3, especially 3 ppm, enhance early plant growth and biochemical composition, demonstrating its importance in horticultural practices.

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