



Effects of Glyphosate on Protein Synthesis in Seedlings of Weed *Hyptis suaveolens* L.

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ABSTRACT

Agrochemical glyphosate is extensively used to control broadleaf weeds and grasses in public spaces, gardens, and agricultural lands. The most apparent effects of glyphosate are more or less the synthesis of protein content. The application of glyphosate in the required amount affects the synthesis of protein in plants. For the present study weed plant *Hyptis suaveolens* L. was utilized to investigate protein synthesis activity by the application of glyphosate. During the study, *Hyptis suaveolens* L. seeds were treated with various amounts of glyphosate at room temperature for 24 hours and allowed to grow in petri dishes. The results reveal that glyphosate steadily lowers seedling protein content from low to high concentrations compared to the control.

Keywords: *Hyptis suaveolens* L., weed, seedlings, Glyphosate, protein synthesis.

1. Introduction

Globally, glyphosate is the most commonly used herbicide, often applied to control weeds in public spaces, gardens, and agricultural lands. Glyphosate is a non-selective systemic herbicide that is applied directly to plant foliage (Tomlin, 2006). When used in smaller quantities, glyphosate can function as a plant growth regulator, influencing plant development. It is a glycine derivative and the IUPAC name for glyphosate is N-(phosphonomethyl) glycine. In plants, the herbicide glyphosate inhibits the enzyme 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS), which disrupts the shikimic acid pathway. This inhibition reduces EPSP production, leading to shortages in essential aromatic amino acids necessary for protein synthesis and plant growth (Vencill, 2002).

Hyptis suaveolens L. belongs to the Lamiaceae family and is commonly considered a weed, especially in tropical and subtropical regions. It is considered one of the most problematic invasive species in the highlands of West-Central India (Sharma *et al.*, 2009). This herb is an annual, aromatic plant native to the tropical Americas but also grows in parts of Africa, Asia, and Australia. The plant is recognizable by its distinctive smell, square-shaped stems, and paired oval opposite leaves with slightly toothed margins. In this work, the weed *Hyptis suaveolens* L. was utilized to investigate protein synthesis activity at varied glyphosate doses.

2. Materials and Methods

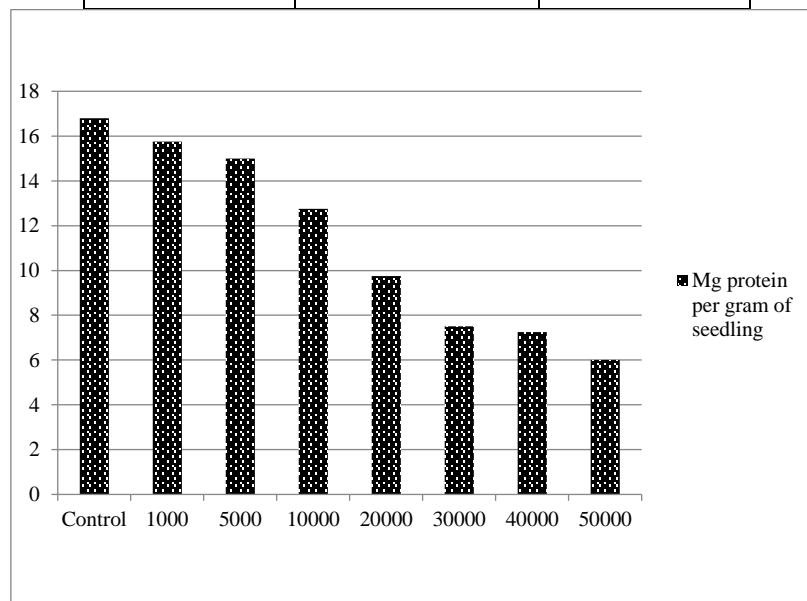
To study the effect of glyphosate on protein synthesis plant species *Hyptis suaveolens* L. was used. It grows vigorously and is commonly found along crop field boundaries, beside railway lines, and along roads in Maharashtra, especially in Vidarbha. During the study, mature seeds of *H. suaveolens* plants were collected from the mother plant growing in their natural habitat. The gathered seeds were treated with glyphosate for 24 hours at concentrations of 1000, 5000, 10000, 20000, 30000, 40000, and 50000 ppm, with distilled water serving as a control. Following treatment, the seeds were carefully cleaned with distilled water and placed in petri plates lined with moistened double-layer filter paper to germinate in a lab setting. For seven days, both the treated and untreated seeds were allowed to grow. In order to isolate and estimate the protein concentration, samples of treated and control seedlings containing 1g of seven-day-old seedlings were collected. For every sample at every glyphosate concentration, four replicates were employed. Protein was extracted and estimated using the Lowry *et al.* method (1951).

3. Result

The results obtained after the treatment with glyphosate show a gradual decrease in protein content as the concentration increases (Table 1 Fig. 1). The percentage of protein milligram per gram seedlings was found to be 15.75, 15.00, 12.75, 9.75, 7.50, 7.25, and 6.00 at 1000, 5000, 10000, 20000, 30000, 40000 and 50000 ppm, respectively and against 16.8 in control. The protein content decreased as the concentration increased. The protein concentration gradually decreased as the glyphosate concentration increased.

Table 1: Effect of Agrochemical Glyphosate on the protein content of seedlings of *Hyptis suaveolens* L.

Agrochemical	Concentration in PPM	Microgram protein per gram seedling
	Control	16.8
Glyphosate	1000	15.75
	5000	15
	10000	12.75
	20000	9.75
	30000	7.5
	40000	7.25
	50000	6.00

**Fig 1.** Graph showing protein per gram of seedling at different concentrations of glyphosate.

4. Discussion

As a gradual decrease in the protein was observed in the present study, this finding is in line with the observation of many researchers. This suggests glyphosate inhibits normal protein synthesis, supporting Hoagland and Duke's 1982 findings that glyphosate primarily inhibits an enzyme essential for plant amino acid and protein production. Mike *et al.* (1983) studied the effect of glyphosate on protein and nucleic acid synthesis and ATP levels in *Xanthium pensylvanicum* root tissue and concluded that glyphosate inhibits protein synthesis. Obidola *et al.* (2020) investigated the effect of glyphosate on the protein concentration of *Arachis hypogaea*. They noted that glyphosate application has an impact on the protein concentration of groundnut, leading to a decrease in its concentration.

5. Conclusion

The present study noted that as the concentration of glyphosate herbicide increases, it adversely affects protein concentration in *Hyptis suaveolens* L. Thus, the weed *Hyptis suaveolens* L. can be controlled by applying a proper amount of glyphosate, as it inhibits the growth of the plant. Further research is recommended, particularly on the effect of glyphosate on the protein constituent in *Hyptis suaveolens* L.

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