IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Effect Of Mycorrhiza Fungus (*Glomus Fasciculata*) On The Morpho -Physiology Of The Plant Species – Phaseolus Vulgaris.

[1]Sourabh Chavan, [1,2]Shweta Magdum, [1]Asad Mujawar, [1]Tammana Mujawar, [1].Shital Kavade

[1] Department of Botany, Jaysingpur College Jaysingpur (Affiliated to Shivaji University Kolhapur) Maharashtra - 416101, India

[2]Department of Botany, Smt. Kasturbai Walchand College, Sangli, (Affiliated to Shivaji University Kolhapur) Maharashtra - 416101, India

Abstract: The study is aims to investigate the impact of Mycorrhiza fungus (*Glomus fasciculata*) on seed germination, sustainability, flowering time, seed vigor, seedling length, stress tolerance, biomass content, and chlorophyll content in the plant Phaseolus vulgaris. We selected this particular plant owing to its short life cycle.

The endomycorrhiza species considered for this experiment was Glomus fasciculata. "Mycorrhiza" translates to "fungal root" from Greek. The main function of mycorrhiza, particularly present in roots, is to transport nutrients and minerals from fungus to the host plant. mycorrhiza is regarded as a Organic fertilizer. In addition to improving nutrient absorption, plant resilience, and plant wellbeing, mycorrhiza also regulate hormones, boost antioxidant levels, maintain soil health, promote biodiversity, use less water and fertilizer, and increase transplant success rates. After being pre-soaked in water for five hours, the Phaseolus vulgaris seeds were treated with varying grades of mycorrhizal concentrations (30%, 60%, and 90%) for four hours. The seeds were then planted in the field, and measurements were made for a number of parameters in comparison with the control. According to the study, significant seed germination was observed at 30% mycorrhiza concentration, and as the concentration of mycorrhiza grows, the percentage of seeds germination falls. When compared to control and other concentrations, the Mycorrhiza fungus exhibited an encouraging impact on seed vigor, plant biomass, stress tolerance, early flowering, and overall plant growth at 30% mycorrhizal concentration. The plant's chlorophyll content significantly increased after being infected with 30% mycorrhiza

Index Terms - Mycorrhiza, Endomycorrhiza, *Glomus fasciculata*, *Phaseolus vulgaris*, Seed vigor, Biomass, antioxidant.

I. INTRODUCTION

Mycorrhiza is a mutually beneficial relationship between certain fungus and the roots of several plant species. Mycorrhiza is a symbiotic association between plant roots and the fungi that live in them. "Mycorrhiza" means "fungal root" in Greek. Albert Bernhard Frank, a German botanist and scientist, conducted the first research on mycorrhiza in (1880). Frank was the first to explain the mutualistic relationship between fungi and trees and coined the term "mycorrhiza". The phrase is derived from the Greek words "mykes" and "rhiza," which translate as "fungus" and "roots," respectively. Frank's initial research cantered on the mutually beneficial relationship and interactions of plant roots and fungal

hyphae. Hyphae are fungal extensions that spread to form the mycelium network. Mycorrhiza is commonly found in roots, and its principal role is to transfer minerals and nutrients from fungus to plant. Mycorrhiza is made up of a vast network of strands. Mycorrhiza removes harmful fungi, retains soil moisture, and promotes rapid root growth. Mycorrhiza is regarded as a "organic fertilizer".

Mycorrhiza influences plant growth in a variety of ways, including improving nutrient absorption, plant resilience, plant wellbeing, boosting antioxidant levels, regulating hormones, maintaining soil health, promoting biodiversity, reducing water and fertilizer usage, and increasing transplant success rates. There are two basic categories of mycorrhiza: 1) Endomycorrhiza 2) Ectomycorrhiza. Endomycorrhiza, on the other hand, tends to penetrate deeper into cortical cells. Ectomycorrhiza, as the name implies, do not penetrate far into the plant [particularly the cortical cells].

Glomus fasciculata is the designated mycorrhiza species for this experiment. This mycorrhiza was chosen-

1] For its non-specificity with host plant.

2] Increases nutrient intake capacity of the plant.

3] function as a biofertilizer.

Phaseolus vulgaris was chosen as the plant for this experiment. The reason for choosing this plant is-

1] Its short life cycle.

2] Dietary foods

3] Requires least maintenance

II. RESEARCH METHODOLOGY :

2.1 Plant materials and seed sterilization

The healthy, vigorous and uniform sized seeds of Phaseolus vulgaris were selected for this experiment.

2.2 Experimental design and salinity treatments

The seeds of the species Phaseolus vulgaris were treated with different grades of Mycorrhizal concentrations 30%,60% and 90%. The treatment was carried out by pre-soaking followed by soaking of seeds in selected Mycorrhizal concentrations. The seeds were pre-soaked for 5 hrs. in distilled water which was followed by soaking in Mycorrhizal grades for 5 hr. For the comparative study control seeds are used which was pre-soaked for 5 hr. followed by soaking in distilled water for 5 hr. in order to compare the effect of Endomycorrhiza (Glomus fasciculata) on overall plant growth .10 seeds were sowed and allowed to grow in the pots. The treatments were placed on the field for ten weeks.

2.3 Observation and data collection

Daily observation and counting of the number of seeds which were germinated were done on fifth day, and germination percentage was calculated. After 70 days of treatment application, measurement of parameters was done and calculated. The parameters studied in the experiment including germination percentage, flowering time, Seed vigour, Seedling length, Stress tolerance, Chlorophyll amount. For each treatment, five plantlets were randomly selected for measurement of morphological characteristics, including plant height, length of shoot, length of root. All morphological characteristics was observed and recorded.

2.4 Measurement of Germination Percentage (GP)

Germination percentage is the actual percentage of the total number of seeds in a sample that germinate out of total in an experiment.

$$GP = \frac{\text{Number of germinated seeds}}{\text{Total number of seeds sown}} \times 100$$

2.5 Survival Percentage

Following seed germination, some of the plantlets that have sprouted suffer harm from outside sources, which leads to their eventual demise. The number of plantlets that remain after damage is used to determine the survival percentage.

2.6 Measurement of Seed vigor

Seed vigor is defined as the whole set of seed qualities that serve as an indicator of seed activity and performance during germination and seedling development. Furthermore, it indicates the seed's reduced ability to complete all physiological operations. The value of plant vigor was determined using the method described by Abdul-Baki and Anderson (1973).

$$\text{Seed vigour} = \frac{\text{Length of hypocotyl+length of radical}}{100} \times GP$$

2.7 Measurement of Biomass

Fresh weight and dry weight of seedling before and after treatments are necessary for determination of biomass. Fresh weight of seedlings in each treatment was obtained on the day of harvest (Day 70). Next, fresh seedling samples were dried at 78°C for 48 h for weight standardization. Seedlings were then weighed again to obtain the dry weight.

2.8 Proline estimation

The plant sample crushed into sulphosalicylic acid. Crushed plant sample was taken to the centrifuge tube and adjusted the level to the 10 ml with sulphosalicylic acid. That sample was centrifuged at 5000 RPM for 10 minutes. 1 ml of supernatant from the centrifuged sample was used for the further procedure. 2 ml ninhydrin reagent and 2 ml glacial acetic acid added to the supernatant. That sample was boiled into the water bath for 1 hour and cooled the sample into the ice bath. 4ml toluene added to the sample. The test tube was Shaked well and allowed to rest for separate the two layers. The upper layer was taken for spectrophotometric analysis of proline at 520 nm wavelength.

2.9 Chlorophyll estimation-

The plant sample from different grades were crushed into 80%Acetone. Crushed plant sample was taken to the centrifuge tube, level of the tube adjusted to 10 ml with Acetone and sample was centrifuged at 3000 RPM for 10 minutes. Supernatant solution was transferred into a 25 ml volumetric flask and made up to 25 ml using 80% Acetone. Colour intensity of green pigment is read at 645 nm 663nm, 652nm for Chlorophyll a, b, and total chlorophyll content respectively using Spectrophotometer.

Chlorophyll a = 12.7 (A at 663) - 2.69 (A at 645nm) x V/1000 x W

Chlorophyll b = 22.9 (A at 645) - 4.69 (A at 663nm) x V/1000 x W

$$\text{Total Chlorophyll} = \frac{A\ at\ 652}{345} \text{ X } 1000V/1000 \text{ x } W$$

Where, A – Absorbance,

V – Final volume the supernatant (25 ml)

W- Fresh weight of the sample taken in gram (0.25 g)

III. RESULTS AND DISCUSSION

3.1 Morphological characteristics:

Table:1- Morphological characteristics at different Mycorrhizal concentration.

Sr.no.	Objective	Treatment concentrations			
		Control	30 % Mycorrhiza	60 % Mycorrhiza	90 % Mycorrhiza
1.	Germination Percentage	100	100	80	40
2.	Flowering Duration	48th Day	42th Day	45th Day	44th Day
3.	Pod or Fruit Length	11	12.4	12.1	12
4.	Av. Root Length	13	19	20	11
5.	Av. Shoot Length	69	112	98	65
6.	Biomass of Plant	4.729 g	13.528 g	5.950 g	3.649 g

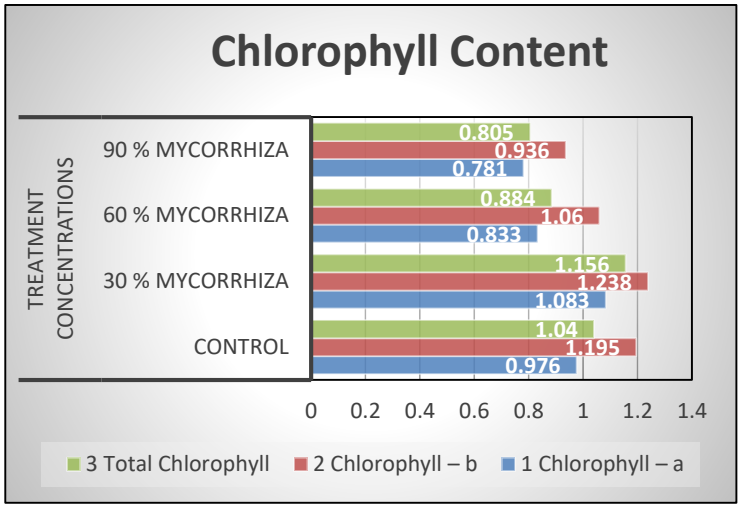
Significant seed germination was observed at 30% mycorrhiza concentration, and as the concentration of mycorrhiza grows, the percentage of seeds germination falls. When compared to control and other concentrations, the Mycorrhiza fungus exhibited an encouraging impact on plant biomass, seedling length , early flowering, and overall plant growth at 30% mycorrhizal concentration. The plant's chlorophyll content significantly increased after being infected with 30% mycorrhiza

3.2 Chlorophyll estimation :

Table:2- Chlorophyll amount estimation at different Mycorrhizal concentration.

Sr.no. 7	Chlorophyll estimation	Treatment concentrations			
		Control	30 % Mycorrhiza	60 % Mycorrhiza	90 % Mycorrhiza
1.	Chlorophyll – a	0.976	1.083	0.833	0.781
2.	Chlorophyll – b	1.195	1.238	1.060	0.936
3.	Total Chlorophyll	1.040	1.156	0.884	0.805

The amount of chlorophyll corresponds to the rate of photosynthesis , so more the amount of chlorophyll more will be the production of photosynthate and more will be the plant biomass . The plant's chlorophyll content significantly increased after being infected with 30% mycorrhiza concentration in comparison with another mycorrhizal concentrations .



Graph No.1 : Chlorophyll estimation

3.3 Seed Vigor:

Table 3: Seed vigour at different Mycorrhizal concentration

Sr.no.	Objective	Treatment concentrations			
		Control	30 % Mycorrhiza	60 % Mycorrhiza	90 % Mycorrhiza
1.	Seed vigour	82	131	70.8	30.4

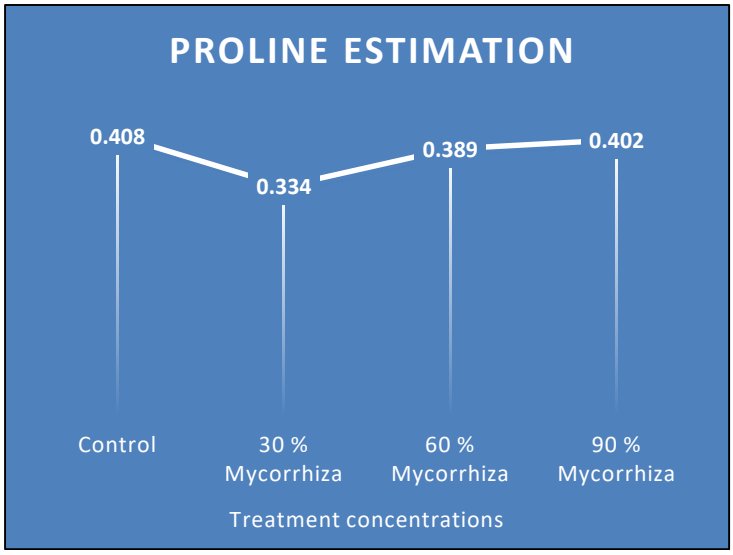
Seed vigour is defined as the whole set of seed qualities that serve as an indicator of seed activity and performance during germination and seedling development. 30 % Mycorrhiza concentration exhibited great increment in seedling length in comparison with another treatment.

3.4 Proline content (mg):

Table:4- Proline content (mg) of different concentration

Sr.no.	Objective	Treatment concentrations			
		Control	30 % Mycorrhiza	60 % Mycorrhiza	90 % Mycorrhiza
1.	Proline estimation	0.408	0.334	0.389	0.402

Proline amino acid accumulates during the stress conditions, playing a crucial role in osmotic regulation, protecting cellular structure and enzymes, and aiding in stress recovery by scavenging reactive oxygen species .Amount of Proline corresponds to the amount of stress induced in the plant . In comparison with all the treatments , the plant exhibited 0.334 amount of proline in plant which directly depicts least amount of stress in plant.



Graph No.2 Proline estimation

IV. CONCLUSION

Significant seed germination was observed at 30% mycorrhiza concentration, and as the concentration of mycorrhiza grows, the percentage of seeds germination falls. When compared to control and other concentrations, the VAM a fungus exhibited an encouraging impact on seed vigour, plant biomass, stress tolerance, early flowering, and overall plant growth.

V. ACKNOWLEDGMENT

The DBT-STAR College Scheme provided financial support for the current study. We are very grateful to Jaysingpur College Jaysingpur Research and Development Cell (RDC) for their assistance. The principal of Jaysingpur College Jaysingpur and the head of the department of botany are thanked by the authors for providing laboratory facilities.

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