



Varietal Response of *Trigonellafoenum-Graecum* (Fenugreek) Against *Rhizobium Meliloti* L. Strain's

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ABSTRACT:

Five different localities from Pravara area (Songoan, Kanadgoan, Dadh, Hanumatgoan, Tambhere) were selected for isolation of *R. meliloti* strains and labeled as R1, R2, R3, R4 & R5. The strains were tested for Varietal Response of *Trigonellafoenum-graecum* (fenugreek) against *Rhizobium meliloti* L. strain's individual and mixed strain combination in this present investigation it was proved that as per the variety and strain combination the growth parameters i.e. percent germination, root length, shoot length, plant height, number of leaves, and biomass showed variation hence there is a urgent need for further investigation on this topic for increasing yield of farmers to boost their economy.

Keywords: *Rhizobium meliloti* L., *Trigonellafoenum-graecum*, strains, biomass

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1. Introduction

Rhizobium is a Gram negative bacterium that is motile and in the form of non-sporulating rods found in the soil that fixes atmospheric nitrogen. It is found mostly in the root nodules where it establishes a symbiotic relationship with the roots of leguminous plants and parasponia. It is also known as biological nitrogen fixation where atmospheric or molecular nitrogen is converted into ammonia by an enzyme named nitrogenase. It converts free nitrogen into nitrogenous salts and helps in making it available for the absorption of plants. The reduction of N_2 into NH_3 requires 6 protons and 6 electrons where 12 molecules of ATP are also involved. The role of nitrogenous compounds in plants is huge as Nitrogen is the constituent element of chlorophyll, cytochromes, alkaloids, and many vitamins. It plays

an important role in different processes like metabolism, reproduction, growth and heredity. Nitrogen is present around 78% in the atmosphere and other forms of nitrogenous compounds include nitrates, nitrites and ammonia. Rhizobium nitrogen fixation is an essential process that takes place biologically and it is the initial stage in the nitrogen cycle. The bacterial species involved in fixing nitrogen include Azotobacter, Cyanobacteria, Anabaena, Nostoc and Rhizobium. Nitrogen fixation also takes place non-biologically where microorganisms are not involved and can be found in the rainy season during lightning.

Trigonellafoenum-graecum plant is also known as methi and used in Ayurvedic medicines for the treatment of bronchitis, rheumatoid arthritis, abscesses or wounds and digestive abnormalities. Fenugreek (*Trigonellafoenumgraecum*) is an annual plant belongs to the family Leguminosae. It is the famous spices in human food. The seeds and green leaves of fenugreek are used in food as well as in medicinal application that is the old practice of human history. It has been used to increase the flavoring and color, and also modifies the texture of food materials. Seeds of fenugreek spice have medicinal properties such as hypocholesterolemic, lactation aid, antibacterial, gastric stimulant, for anorexia, antidiabetic agent, galactogogue, hepatoprotective effect and anticancer. These beneficial physiological effects including the antidiabetic and hypocholesterolemic effects of fenugreek are mainly attributable to the intrinsic dietary fiber constituent which have promising nutraceutical value (Srinivasan, 2006). It is well known for its fiber, gum, other chemical constituents and volatile contents. Dietary fiber of fenugreek seed is about 25% which changes the texture of food. These days it is used as food stabilizer, adhesive and emulsifying agent due to its high fiber, protein and gum content. The protein of fenugreek is found to be more soluble at alkaline pH (Meghwal and Goswami, 2012). Fenugreek is having beneficial influence on digestion and also has the ability to modify the food. Fenugreek is used as a herb (dried or fresh leaves), spice (seeds), and vegetable (fresh leaves, sprouts, and microgreens). Sotolon is the chemical responsible for the distinctive maple syrup smell of fenugreek.

Therefore in the present investigation efforts were made to investigate Varital Response of *Trigonellafoenum-graecum* (fenugreek) against *Rhizobium meliloti* L. strain's to find out the effective strain of *Rhizobium meliloti* L. & to increase the productivity & yield of local farmers

2. Materials and Methods: -

A) Collection of plant material & different varieties of Fenugreek

Five different localities (Songoan, Kanadgoan, Dadh ,Hanumatgoan, Tambhere) were selected from pravara area for isolation of *meliloti* strains and labeled as R₁, R₂ R₃ R₄& R₅

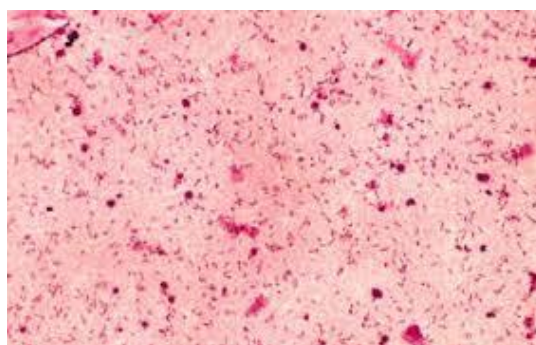
B) Isolation of *Rhizobium meliloti* L.

In laboratory root systems were separated and were washed with tap water to remove adhering soil particles. Two to four healthy pinkish root nodules were selected from each root system with the help of sterilized forceps. Selected nodules were surface sterilized with 0.1% mercuric chloride solution for 3 minutes then serially washed with sterilized distilled water two to three times to remove toxic residue of mercuric chloride. The sterilized root nodules were crushed in 5 ml. sterilized distilled water in sterile test tube in order to get "ooze of *R. japonicum*. 1 ml. suspension was spread over Yeast Extract Mannitol Agar (YEMA) medium. (Tilak, 1993). Inoculated plates were incubated at 25 +2 °C for 3 to 5 days whitish translucent growth was occurred on medium. After confirmation of their biochemical characters and morphological characteristics these cultures were transferred on pure yeast extract mannitol agars slants and were maintained by transfer and retransfer.

Morphology

C) Gram Staining

One drop of two days old culture of isolates were used for staining. Each isolate was placed separately and smear was spread on glass slide with the help of another slide. Then slides were warmed on spirit lamp for drying and fixation. The dried smear was stained with iodine for two minutes and then washed with tap water first and then with 95% ethanol again with tap water and were stained with counter stain saffranine for 20-30 seconds and washed with tap water. The prepared slides were observed under oil immersion.



Gram Staining

Capsule staining

Seven days old liquid culture broths were used for capsule staining. One drop of each isolate was placed separately on glass slide and stained with India ink and smears were prepared these were gently heat on spirit lamp to fix the smear. Smear was stained with crystal violet for one minute then gently washed with tap water and covered with coverslip finally slides were pressed with filter paper until the ink was sepia colour beneath the coverglass and slide was observed under microscope.



Capsule staining

Preparation of Liquid culture media

YEMA liquid media without agar powder were made and autoclaved after autoclaving the liquid media cool to maintain the room temperature, then the pour 50 ml in each conical flasks the flask were inoculated with the pure culture and sealed with cotton plugs, & placed for incubation in incubator for 3days.

Seed treatment

seed treatment was given to the different varieties of Fenugreek by placing 10 seeds of each variety in the liquid culture broth for overnight, separately in each single strain broth & also

in the Combination of strains i.e. R_1+R_2 , R_3+R_4 , $R_1+R_2+R_3$, $R_3+R_4+R_5$, $R_1+R_3+R_5$, and distilled water soaked seeds as a control

Growth Parameters

After five days the count of the germination was taken and the percentage of germination was calculated. After 15 days the measurement of average plant leaves, plant shoot length, plant root length, plant fresh weight, dry weight was recorded

3. Results and Discussion

From the result summarized in table no.1 it was noticed that variation in the percent germination as per the strain & variety. The highest seed germination percent (100%) observed in R_2 , R_4 & R_5 followed by R_4 & R_5 as compare to control in the variety 7 Star. However in the variety Diamond R_2 , R_3 , R_4 & R_5 100% seed germination noticed, where as in the variety Gulab 100 % seed germination noticed in all five stains as compare to control (60%), in the varietyDoller except R_1 (80%) R_2 , R_3 , R_4 & R_5 showed 100% seed germination. In the variety Lal-cora only the R_4 & R_5 strain showed 100% seed germination followed by R_2 (60%) strain.

From table no.2 it was revealed that variation in the percent germination as per the Mix strain and variety. The highest seed germination percent (100%) observed in R_1+R_2 , $R_3+R_4+R_5$ & $R_1+R_3+R_5$ followed by R_3+R_4 (80%) as compare to control in the variety 7 Star. However in the variety Diamond R_1+R_2 100% seed germination noticed followed by R_3+R_4 , $R_1+R_2+R_3$, $R_3+R_4+R_5$ and $R_1+R_3+R_5$ (80%) where as in the variety Gulab R_3+R_4 , $R_1+R_2+R_3$, $R_3+R_4+R_5$ and $R_1+R_3+R_5$ showed 100 % seed germination followed by R_1+R_2 combination stains(60%) as compare to control (80%), in the variety Doller R_1+R_2 , $R_3+R_4+R_5$, $R_1+R_3+R_5$ showed 100% seed germination followed by $R_1+R_2+R_3$ (80%) R_2 , R_3 , R_4 & R_5 showed 100% seed germination. In the variety Lal-cora R_1+R_2 , $R_1+R_2+R_3$, $R_3+R_4+R_5$, & $R_1+R_3+R_5$ (80%) .

From the result summarized in table no.3 it was noticed that variation in the Shoot and Root length as per the strain & variety. The highest Average Shoot length observed in R_1 , R_2 , R_3 & R_4 followed by R_5 as compare to control in the variety 7 Star. However in the variety Diamond The highest Average Shoot length observed in R_2 , R_3 , R_4 & R_1 follow by R_5 as compare to control, where as in the variety Gulab The highest Average Shoot length observed in R_1 & R_2 as compare to control, in the varietyDoller except R_2 , R_3 , R_4 showed highest Average Shoot length. In the variety Lal-cora the R_1 , R_4 & R_5 strain showed highest Average Shoot length followed by R_2 , R_3 strain. The highest Average Root length observed in R_5 , R_3 followed by R_1 , R_2 & R_4 as compare to control in the variety 7 Star. However in the variety Diamond The highest Average Root length observed in R_2 , R_4 , follow by R_1 , R_3 & R_5 as compare to control, where as in the variety Gulab The highest Average Root length observed in R_5 as compare to control, in the varietyDoller except R_1 & R_5 showed highest Average Root length. In the variety Lal-cora the R_1 & R_4 strain showed highest Average Root length followed by R_2 , R_3 & R_5 strain.

From the result summarized in table no.4 it was noticed that variation in the Shoot and Root length as per the Mix strain & variety. The highest Average Shoot length observed in $R_1+R_3+R_5$, $R_3+R_4+R_5$ & $R_1+R_2+R_3$ followed by R_3+R_4 , R_1+R_2 as compare to control in the variety 7 Star. However in the variety Diamond The highest Average Shoot length observed in R_3+R_4 , $R_3+R_4+R_5$, $R_1+R_3+R_5$ follow by R_1+R_2 , $R_1+R_2+R_3$ as compare to control, where as in the variety Gulab The highest Average Shoot length observed in $R_3+R_4+R_5$ & $R_1+R_2+R_3$ as compare to control, in the varietyDoller except R_1+R_2 , $R_3+R_4+R_5$, $R_1+R_2+R_3$ showed highest Average Shoot length. In the variety Lal-cora the $R_3+R_4+R_5$, $R_1+R_2+R_3$, $R_1+R_3+R_5$ strain

showed highest Average Shoot length followed by R_1+R_2 , R_3+R_4 strain. The highest Average Root length observed in $R_3+R_4+R_5$, followed by R_1+R_2 , R_3+R_4 , $R_1+R_2+R_3$ & $R_1+R_3+R_5$ as compare to control in the variety 7 Star. However in the variety Diamond The highest Average Root length observed in R_3+R_4 follow by R_1+R_2 , $R_1+R_2+R_3$ & $R_3+R_4+R_5$, $R_1+R_3+R_5$ as compare to control, where as in the variety Gulab The highest Average Root length observed in $R_1+R_2+R_3$, $R_3+R_4+R_5$ & $R_1+R_3+R_5$ as compare to control, in the varietyDoller except R_3+R_4 showed highest Average Root length. In the variety Lal-cora the $R_3+R_4+R_5$ strain showed highest Average Root length followed by R_1+R_2 , R_3+R_4 , $R_1+R_2+R_3$ & $R_1+R_3+R_5$ strain.

From the result summarized in table no.5 it was noticed that variation in the Plant Growth & Biomass as per the strain & variety. The highest Plant Growth observed in R_3 , R_1 & R_5 followed by R_2 , R_4 as compare to control in the variety 7 Star. However in the variety Diamond The highest Plant Growth observed in R_2 & R_4 follow by R_1 , R_3 & R_5 as compare to control, where as in the variety Gulab The highest Plant Growth observed in R_5 , R_1 & R_2 as compare to control, in the varietyDoller except R_1 & R_5 showed highest Plant Growth. In the variety Lal-cora the R_1 , R_4 & R_5 strain showed highest Plant Growth followed by R_2 , R_3 strain. The highest No. of Leaves observed in R_5 , R_4 & R_3 followed by R_1 , R_2 as compare to control in the variety 7 Star. However in the variety Diamond The highest No. of Leaves observed in all strains as compare to control, where as in the variety Gulab The highest No. of Leaves observed in R_5 as compare to control, in the varietyDoller except R_3 & R_5 showed highest No. of Leaves. In the variety Lal-cora the R_5 , R_3 & R_1 strain showed highest No. of Leaves followed by R_2 , R_4 strain. The highest Biomass observed in R_5 , R_4 followed by R_1 , R_2 & R_3 as compare to control in the variety 7 Star. However in the variety Diamond The highest Biomass observed in R_2 , R_3 , follow by R_1 , R_4 & R_5 as compare to control, where as in the variety Gulab The highest Biomass observed in R_3 & R_5 as compare to control, in the varietyDoller except R_5 & R_3 showed highest Biomass. In the variety Lal-cora the R_5 & R_4 strain showed highest Biomass followed by R_1 , R_2 & R_3 strain.

From the result summarized in table no.6 it was noticed that variation in the Plant Growth & Biomass as per the Mix strain & variety. The highest Plant Growth observed in $R_3+R_4+R_5$, $R_1+R_2+R_3$ & $R_1+R_3+R_5$ followed by R_1+R_2 , R_3+R_4 as compare to control in the variety 7 Star. However in the variety Diamond The highest Plant Growth observed in R_3+R_4 & $R_1+R_2+R_3$ follow by R_1+R_2 , $R_3+R_4+R_5$ & $R_1+R_3+R_5$ as compare to control, where as in the variety Gulab The highest Plant Growth observed in $R_3+R_4+R_5$ & $R_1+R_2+R_3$ as compare to control, in the varietyDoller except R_1+R_2 & $R_3+R_4+R_5$ showed highest Plant Growth. In the variety Lal-cora the $R_3+R_4+R_5$ & $R_1+R_2+R_3$ strain showed highest Plant Growth followed by R_1+R_2 , R_3+R_4 , $R_1+R_3+R_5$ strain. The highest No. of Leaves observed in R_3+R_4 followed by R_1+R_2 , $R_1+R_2+R_3$, $R_3+R_4+R_5$ & $R_1+R_3+R_5$ as compare to control in the variety 7 Star. However in the variety Diamond The highest No. of Leaves observed in R_3+R_4 as compare to control, where as in the variety Gulab The highest No. of Leaves observed in R_3+R_4 as compare to control, in the varietyDoller except R_3+R_4 showed highest No. of Leaves. In the variety Lal-cora the R_3+R_4 strain showed highest No. of Leaves followed by R_1+R_2 , $R_1+R_2+R_3$, $R_3+R_4+R_5$ & $R_1+R_3+R_5$ strain. The highest Biomass observed in $R_3+R_4+R_5$ & $R_1+R_3+R_5$ followed by R_1+R_2 , R_3+R_4 & $R_1+R_2+R_3$ as compare to control in the variety 7 Star. However in the variety Diamond The highest Biomass observed in $R_1+R_2+R_3$ & $R_3+R_4+R_5$, follow by R_1+R_2 , R_3+R_4 & $R_1+R_3+R_5$ as compare to control, where as in the variety Gulab The highest Biomass observed in $R_3+R_4+R_5$ & R_3+R_4 as compare to control, in the varietyDoller except R_3+R_4 & $R_3+R_4+R_5$ showed highest Biomass. In the variety Lal-cora the $R_3+R_4+R_5$ & R_3+R_4 strain showed highest Biomass followed by R_1+R_2 , $R_1+R_2+R_3$ & $R_1+R_3+R_5$ strain.

Table No 1: Effect of Rhizobium meliloti L. strain on seed germination of different varieties of Fenugreek Germination Percentage (%) after 5 day table

Sr. no.	strains	Variety										
		7 Star			Diamond		Gulab		Doller		Lal-cora	
		No. of seed placed for germination	No. of Germinated	Germination (%)	No. of Germinated	Germination (%)	No. of Germinated	Germination (%)	No. of Germinated	Germination (%)	No. of Germinated	Germination (%)
1	R ₁	5	4	80%	4	80%	5	100%	4	80%	2	40%
2	R ₂	5	5	100%	5	100%	5	100%	5	100%	3	60%
3	R ₃	5	4	80%	5	100%	5	100%	5	100%	5	100%
4	R ₄	5	5	100%	5	100%	5	100%	5	100%	5	100%
5	R ₅	5	5	100%	5	100%	5	100%	5	100%	4	80%
6	Control	5	4	80%	3	60%	4	80%	4	80%	4	80%

Note :-R₁-Songoan strain

R₂-Kanadgoan strain

R₃-Dadh strain

R₄-Hanumantgoan strain

R₅-Tambhere strain

Table No 2: Combination effect of strain of Rhizobium meliloti L. strain on seed germination of different varieties of Fenugreek(after 5 days)

Sr. no.	strains	Variety										
		7 Star			Diamond		Gulab		Doller		Lal-cora	
		No. of seed placed for germination	No. of Germinated	Germination (%)	No. of Germinated	Germination (%)	No. of Germinated	Germination (%)	No. of Germinated	Germination (%)	No. of Germinated	Germination (%)
1	R ₁ +R ₂	5	5	100%	4	80%	3	60%	5	100%	4	80%
2	R ₃ +R ₄	5	4	80%	5	100%	5	100%	4	80%	3	60%
3	R ₁ +R ₂ +R ₃	5	3	60%	4	80%	5	100%	1	20%	4	80%
4	R ₃ +R ₄ +R ₅	5	5	100%	4	80%	5	100%	5	100%	4	80%
5	R ₁ +R ₄ +R ₅	5	5	100%	4	80%	5	100%	5	100%	3	60%
6	Control	5	4	80%	3	60%	4	80%	4	80%	4	80%

Note :-R₁-Songoan strain

R₂-Kanadgoan strain

R₃-Dadh strain

R₄-Hanumantgoan strain, R₅-Tambhere strain

Table No 3: Effect of Rhizobium meliloti L. strain on shoot & Root length of different varieties of Fenugreek

Sr. no.	strains	Variety																							
		7 Star				Diamond				Gulab															
		Shoot Length(cm)		Average shoot length(cm)		Root Length(cm)		Average root length(cm)		Shoot Length(cm)		Average shoot length(cm)		Root Length(cm)		Average root length(cm)									
1	R ₁	7	7	6	6.6	6	3	2	3.6	5	5	4	4.6	4	4	2	3.3	5	5	6	5.3	2	3	4	3
2	R ₂	5	6	5	5.3	3	5	2	3.3	6	5	5	5.3	6	5	3	4.6	5	5	5	5	3	2	3	2.2
3	R ₃	6	6	6	6	7	5	2	4.6	4	4	4	4	5	4	2	3.6	4	5	4	4.3	2	4	1	2.3
4	R ₄	7	5	6	6	4	3	3	3.3	4	5	3	4	4	6	3	4.3	5	5	4	4.6	4	3	1	2.6
5	R ₅	5	4	5	4.6	8	5	4	5.6	4	4	3	3.6	3	3	2	2.6	4	5	5	4.6	3	5	5	4.3
6	Control	4	3	3	3.3	7	1	1	3	6	2	2	3.3	7	1	5	3.5	5	3	2	3.3	3	1	1	1.6

Note :-R₁-Songoan strain
R₂-Kanadgoan strain
R₃-Dadh strain
R₄-Hanumantgoan strain
R₅-Tambhere strain

Table no 4: Combination Effect of Rhizobium meliloti L. strain on shoot & Root length of different varieties of Fenugreek after 14 days

S r. n o.	strai ns	Variety															
		Doller							Lal- cora								
		Shoot Length(cm)			Avera ge shoot length (cm)	Root Length(cm)			Avera ge root length (cm)	Shoot Length(cm)			Avera ge shoot length (cm)	Root Length(cm)			Avera ge root length (cm)
1	R ₁	7	6	5	6	8	7	4	6.3	5	5		5	5	4	4.5	
2	R ₂	6	6	5	5.6	2	2	2	2	5	5	4	4.6	3	2	2	2.3
3	R ₃	6	5	3	4.6	4	4	2	3.3	5	5	3	4.3	6	4	2	4
4	R ₄	5	5	5	5	4	2	2	2.6	5	5	5	5	3	6	4	4.3
5	R ₅	4	4	4	4	6	4	4	4.6	6	5	5	5.3	5	4	3	4
6	Con trol	5	3	3	3.4	5	2	1	2.6	5	5	5	5	4	3	3	3.5

Note :-R₁-Songoan strain
R₂-Kanadgoan strain
R₃-Dadh strain
R₄-Hanumantgoan strain
R₅-Tambhere strain

Table No 5: Effect of Rhizobium meliloti L. strain on plant growth & biomass of different varieties of Fenugreek

S r. n o.	stra ins	Variety											
		7 Star				Diamond				Gulab			
		Pla nt Hei ght (cm)	No . of lea ves	Fre sh Wei ght (gm)	Dry Wei ght (gm)	Pla nt Hei ght (cm)	No . of lea ves	Fre sh Wei ght (gm)	Dry Wei ght (gm)	Pla nt Hei ght (cm)	No . of lea ves	Fre sh Wei ght (gm)	Dry Wei ght (gm)
1	R ₁	10.2	3	0.259	0.026	7.9	3	0.361	0.036	8.3	3	0.234	0.023
2	R ₂	8.6	2	0.390	0.037	9.9	3	0.690	0.071	8	2	0.76	0.006
3	R ₃	10.6	3	0.371	0.033	7.6	3	0.558	0.073	6.6	3	0.483	0.052
4	R ₄	9.3	3	0.577	0.057	8.3	3	0.445	0.049	7.2	3	0.330	0.037
5	R ₅	10.	6	0.72	0.086	6.2	3	0.52	0.055	8.9	6	0.40	0.052

		2		4				0				5	
6	Control	7.6	2	0.148	0.022	8	2	0.115	0.009	6.6	2	0.120	0.013

Note :-R₁-Songoan strain

R₂-Kandgoan strain

R₃-Dadh strain

R₄-Hanumantgoan strain

R₅-Tambhere strain

Table No 6: Combination Effect of Rhizobium meliloti L. strain on plant growth & biomass of different varieties of Fenugreek

Sr. no.	strains	Variety							
		Doller				Lal- cora			
		Plant Height (cm)	No. of leaves	Fresh Weight (gm)	Dry Weight(gm)	Plant Height (cm)	No. of leaves	Fresh Weight (gm)	Dry Weight(gm)
1	R ₁	12.3	3	0.562	0.055	9.5	3	0.291	0.028
2	R ₂	7.6	3	0.604	0.056	6.9	2	0.420	0.046
3	R ₃	7.9	6	0.664	0.067	8.3	4	0.480	0.051
4	R ₄	7.6	3	0.479	0.048	9.3	2	0.594	0.056
5	R ₅	8.6	6	0.722	0.094	9.3	7	0.836	0.096
6	Control	6.9	2	0.280	0.018	8.5	2	0.095	0.022

Note :-R₁-Songoan strain

R₂-Kandgoan strain

R₃-Dadh strain

R₄-Hanumantgoan strain

R₅-Tambherestrain

Sr. no.	strains	Variety											
		7 Star				Diamond				Gulab			
		Plant Height (cm)	No. of leaves	Fresh Weight (gm)	Dry Weight (gm)	Plant Height (cm)	No. of leaves	Fresh Weight (gm)	Dry Weight (gm)	Plant Height (cm)	No. of leaves	Fresh Weight (gm)	Dry Weight (gm)
1	R ₁ +R ₂	8	3	0.622	0.057	6.6	3	0.477	0.046	6.3	3	0.266	0.024
2	R ₃ +R ₄	8.2	6	0.560	0.061	11.2	6	0.505	0.061	6.9	6	0.464	0.056
3	R ₁ +R ₂ +R ₃	9	3	0.300	0.022	9.3	3	0.597	0.048	8.6	3	0.280	0.021
4	R ₃ +R ₄ +R ₅	10	3	0.767	0.065	8.6	3	0.554	0.055	10.6	3	0.595	0.052
5	R ₁ +R ₂	8.9	3	0.6	0.057	8.2	3	0.5	0.053	6.6	2	0.2	0.038

	3+R ₅			62				31				04	
6	Control	7.6	2	0.148	0.022	8	2	0.115	0.009	6.6	2	0.120	0.013

Sr. no.	strains	Variety							
		Doller				Lal- cora			
		Plant Height (cm)	No. of leaves	Fresh Weight (gm)	Dry Weight (gm)	Plant Height (cm)	No. of leaves	Fresh Weight (gm)	Dry Weight (gm)
1	R ₁ +R ₂	9.3	3	0.464	0.040	6.9	2	0.475	0.040
2	R ₃ +R ₄	9	6	0.709	0.069	8.2	4	0.783	0.074
3	R ₁ +R ₂ +R ₃	8	3	0.110	0.009	9	3	0.301	0.024
4	R ₃ +R ₄ +R ₅	9.3	3	0.643	0.058	9.6	3	0.810	0.077
5	R ₁ +R ₃ +R ₅	7.6	3	0.509	0.042	7.3	3	0.391	0.040
6	Control	6.9	2	0.280	0.018	8.5	2	0.095	0.022

Note :-R₁-Songoan strain,R₂-Kanadgoan strain, R₃-Dadh strain, R₄-Hanumantgoan strain, R₅-Tambhere strain

Note :-R₁-Songoan strain

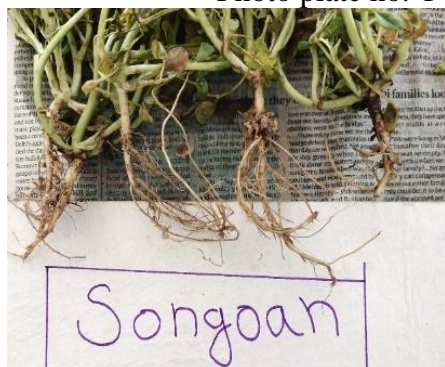
R₂-Kanadgoan strain

R₃-Dadh strain

R₄-Hanumantgoan strain

R₅-Tambhere strain

Photo plate no.-1 Collection of plant sample



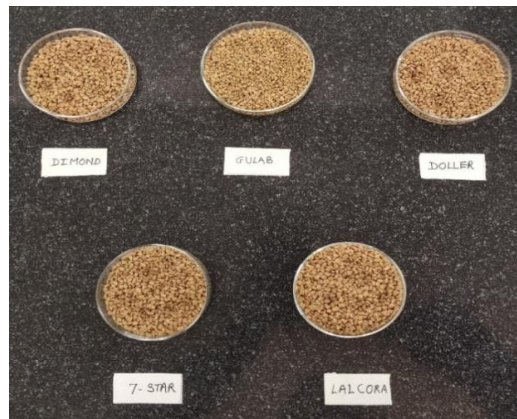
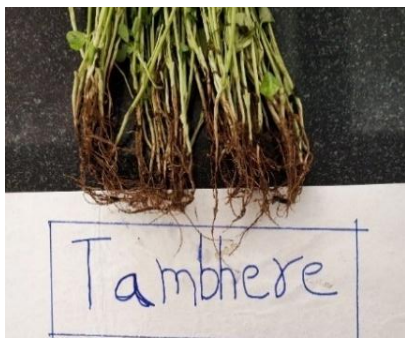
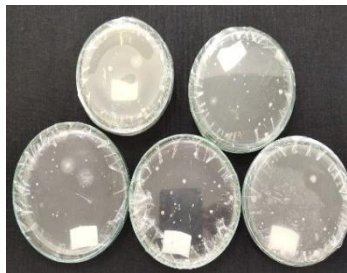
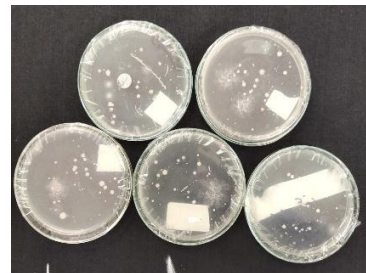


Photo plate no.-2 Isolation of *R. Meliloti* strain on YEMA medium



R₁-Songoan



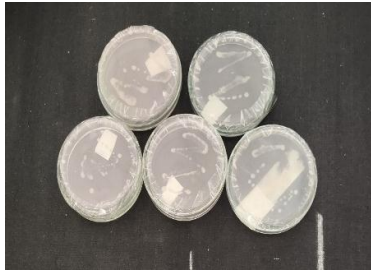
R₂-Kanadgoan



R₃-Dadh



R₄-Hanumantgoan



R₅-Tambhere



Pure culture

Photo plate no.-3 Seed germination & Plant growth



Treated Seeds placed for germination



Seed germination noticed



Seedling growth

4. Conclusion

From the present investigation it was proved that the effects of five isolated strains of *Rizobiummeliloti* effect variously on five selected varieties of fenugreek on % germination and various growth parameters studied in this investigation.

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