



A comparative study on effect of 'Jaipur' and 'Kirana' style classical vocal music on germination and growth of *Cicer arietinum* L.

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ABSTRACT

Cicer arietinum L. is a cash crop in Indian subcontinent. It was treated to check the effect on germination and growth with classical vocal music of 'Kirana' and 'Jaipur' Gharana legends viz. Pt. Bhimsen Joshi and Pt. Mallikarjun Mansur respectively. The 'Morning', 'Afternoon', 'Evening' and 'Night' time ragas were selected. The Evening raga (Multani) (of both Gharana) has shown strong and more positive effect on the germination and growth of *Cicer* sp. The treatment of morning raga ('Vibhas') of Jaipur style is not suited for germination whereas same of Kirana style also shown minimum germination with respect to control.

Keywords: *Cicer arietinum*, Classical vocal, Kirana, Jaipur-Atrauli, Raga.

INTRODUCTION

'Indian Classical Music' is divided in to two types 'North Indian' and 'South Indian' style. 'Khayal Gayaki' is the recent version of classical music. The North Indian classical music has tradition of particular style of singing called 'Gharana' which generally come in to existence after three successive generations of vocalists. The 'Kirana', 'Jaipur' and 'Agra' are the most popular gharana in Indian classical music. 'Bhendibajar', 'Rampur-Sahaswan', 'Patiyala' are also some of other gharanas. The Gharanas are having own special emphasize and expertise on certain parts of music along with very complex architecture of composition/s.

Late Ustad Abdul Karim Khan Saheb is the founder of 'Kirana Gharana' and the style is known to be 'Swar Pradhan Gayaki'. Late Ustad Alladiya Khan Saheb founded 'Jaipur-Atrauli Gharana' (commonly referred as- 'Jaipur Gharana') and its style is known for 'Laya Pradhan Gayaki'.

The traditions of 'Kirana' and 'Jaipur' Gharana are made more famous in the world of music by its disciples. The 'Guru-Shishya Parampara' (Teacher-Student tradition) of these 'Gharanas' is vast and having streams. One of the prominent streams of these 'Gharana' is - 1) '**Kirana Gharana**'- Abdul Karim Khan Saheb- Sawai Gandharva- Pt. Bhimsen Joshi. 2) '**Jaipur Gharana**'- Alladiya Khan Saheb- Manji Khan Saheb- Pt.



Pt. Mallikarjun Mansur (Jaipur Gharana)



Pt. Bhimsen Joshi (Kirana Gharana)

Images- <https://www.google.com>

Mallikarjun Mansur. The audio recordings by *Pt. Bhimsen Joshi* ('Bharat-Ratna'- 2009) and *Pt. Mallikarjun Mansur* ('Padma-Vibhushan'- 1992) were selected to see the effect.

The Indian classical music has classified ragas on the basis of A) 'Thaat' (Presence of Shuddha/Komal/Tivra Swar). B) 'Gaan Samay' (Time of Singing / Playing). The 'Morning', 'Afternoon', 'Evening' and 'Night' times are broadly considered scales for classifying ragas according to time. The 'Gaan Samay' (Time of Singing/Playing) is also sub-divided in to finer parts called 'Prahar' (Clock time). The present work considers the broader scale for analysis.

Plants are complex multicellular organisms that may not 'hear' sounds, but several current studies have shown that plants can respond to music. Sound waves can be transmitted by medium, materials and plants response to music can cause changes in metabolism, which affect plant growth (Creath & Schwartz 2004).

The study on the growth of crops concerning natural factors like air, water, light, temperature, and nutrients has been conducted; a genuine focus on interaction of the plants to the sound factor has never been prioritized (Mishra et. al., 2016). The musical vibrations stimulated the seed germination of Okra and Zucchini (Creath, 2002). The effect of musical note on *Cicer arietinum* L. is not studied.

Material and Method- Seeds of *Cicer* sp. were sown in 10 different pots having 100 seeds/pot. All of the pots were provided with uniform conditions without adding fertilizers. The music was played for 25 min. with the help of speaker. Selected ragas are (1). Morning: Raga 'Vibhas' (Komal Dhaiwat), (2).

Afternoon: Raga 'Gaud Sarang', (3). Evening: Raga 'Multani', (4). Night: Raga 'Darbari Kanada' and were sung by both legends A) *Pt. Mallikarjun Mansur* (Jaipur Gharana) and B) *Pt. Bhimsen Joshi* (Kirana Gharana). The time to play the raga was also fixed. Morning raga was played at 8:30 am. Afternoon raga at 12:30 pm. Evening raga at 6:30 pm and Night raga at 8:30 pm (Rachieru et. al., 2017; Gautama & Ragavan 2013).

RESULTS

In 'Kirana Gharana' treated samples (Table-1) the 'Control' has shown maximum (99%) germination while minimum in recorded in 'Vibhas' (91%). The difference between 'Multani' and 'Darbari Kanada' is (1%) whereas, 'Gaud Sarang' and 'Vibhas' have difference of (2%). The longest shoot is recorded in 'Control' (34.5 cm) whereas, 'Gaud Sarang' and 'Multani' have same results (33 cm). 'Vibhas' is having minimum growth (31.2 cm). The frequency, intensity and exposure time to sound are the factors that affect the plant. The low frequency sound activates enzymes instead of damaging cell structure (Hari et. al., 2021). The shortest shoot is recorded in 'Control' i.e. (10 cm) which is comparable with 'Vibhas' (10.2 cm). Highest growth recorded in 'Darbari Kanada' (17 cm). The longest root is recorded in 'Gaud Sarang' (27.9 cm) followed by 'Multani' (27 cm). Minimum observed in the control (20 cm). The difference of (7.9 cm) is recorded between 'Control' and 'Gaud Sarang'.

Shortest root is recorded in 'Vibhas' (0.5 cm) and 'Multani' is having 6 times growth (3 cm) with respect to 'Vibhas'. 'Gaud Sarang', 'Darbari Kanada' and 'Control' have same result (1 cm).

The highest average total length is in the 'Gaud Sarang' 37.55 cm and 'Multani' shows nearly same growth (37.32 cm). The lowest recorded in 'Control' (34.15 cm).

Average of the average total length is (36.95 cm) whereas control shows (34.15 cm). The 'Control' is having less growth with respect to samples.

In 'Jaipur Gharana' treated samples the 'Gaud Sarang' has shown maximum (98%) germination and minimum in the 'Vibhas' (56%). 'Rock music' found to inhibit the alfalfa seed germination. Seedlings exposed to nature sound or jazz resulted in negative growth of hypocotyls. Advance studies are needed to decide the

specific factor within each type of music which is causing negative effects (Lai & Wu, 2020).

The longest shoot is recorded in 'Control' (35 cm) shortest in the 'Vibhas' (30 cm). The shortest shoot is observed in 'Darbari Kanada' (8 cm), 'Vibhas' and 'Gaud Sarang' shown same (11 cm) results and maximum recorded in 'Multani' i.e. (20 cm).

The longest root is observed in 'Multani' (20.5 cm) while shortest noted in 'Control' (15.3 cm). The shortest root growth is recorded minimum in 'Vibhas' and Gaud Sarang' (1 cm) and maximum is in 'Control' (5.5 cm).

Table 1- % Germination and Root-Shoot length

Sr. no.	Gharana	Raga	% Germination	Longest Shoot (cm)	Shortest Shoot (cm)	Longest Root (cm)	Shotest Root (cm)	Average total Length (cm)	Average of the Average total length (cm)
1	Kirana	Vibhas	91	31.2	10.2	26.5	0.5	36.86	36.95
2		Gaud Sarang	93	33	13	27.9	1	37.55	
3		Multani	97	33	14	27	3	37.32	
4		Darbari Kanada	96	32	17	24.5	1	36.08	
5		Control	99	34.5	10	20	1	34.15	
6	Jaipur	Vibhas	56	30	11	19	1	29.56	35.56
7		Gaud Sarang	98	31	11	15.7	1	35.98	
8		Multani	97	32	20	20.5	1.3	38.66	
9		Darbari Kanada	96	34	8	18.5	3	38.05	
10		Control	90	35	19.3	15.3	5.5	38.16	

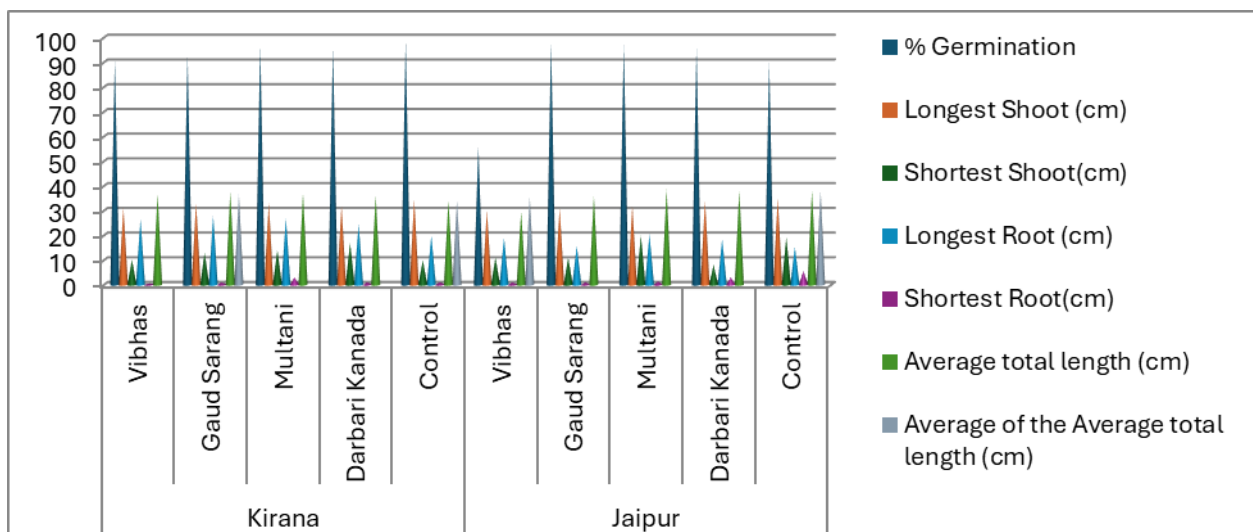


Figure 1: Graphical - % Germination and Root-Shoot length

Average total length in samples treated with 'Jaipur Gharana' is observed to be maximum in 'Multani' i.e. (38.66 cm) followed by 'Darbari Kanada' (38.05 cm). Minimum growth is recorded in 'Vibhas' (29.56 cm). Average of the average total length is maximum in 'Control' (38.16 cm) and (35.56 cm) in samples.

In 'Kirana Gharana' treated samples (Table-2) percent number of individuals grown above average shoot length is seen maximum in 'Multani' (72.16%) followed by 'Gaud Sarang' (61.29%) and minimum recorded in 'Control' i.e. (55.55%). The 'Multani' treated sample shows (16.61%) more growth than 'Control'. The percent number of individuals grown below average shoot length is recorded minimum in raga 'Multani' (27.83%). The maximum number of individuals grown below average shoot length recorded in 'Control' (44.44%). The 'Control' is comparable with 'Raga Darbari Kanada' and 'Vibhas'. 'Raga Vibhas' (41.75%) and 'Darbari Kanada' (43.75%) have difference of 2 %.

The percent number of individuals grown above average root length is maximum in 'Control' (57.57%). 'Vibhas' (53.84%) and 'Multani' (53.60%) shows nearly same results and minimum is recorded in the 'Gaud Sarang' (45.16%). In percent number of individuals grown below average root length, the minimum result is observed in the 'Control' (42.42 %). Raga 'Vibhas' (46.1%) and 'Multani' (46.39%) appeared nearly same. The classical music accelerated the development time of lettuce, unlike the crops

exposed to environmental noise (Salazar et. al., 2024). In samples treated with 'Jaipur Gharana', the number of individuals grown above average shoot length is maximum in 'Vibhas' (66.07%). Raga 'Gaud Sarang' (59.18%) and 'Darbari Kanada' (58.33%) show difference of (0.85%). The minimum is observed in 'Control' (53.33%). The 'Vibhas' treated sample shows (12.74%) more growth than 'Control'.

'Music', 'Some natural sounds', 'Chanting' or 'Any another physical disturbance' etc. are some of external vibrations which are capable of changing internal factors. At resonant frequencies, the sound can either stimulate or hamper growth. Further advanced research has to be conducted in order to increase the biochemical assay (Mohan et. al., 2019).

The percent number of individuals grown below average shoot length is noted minimum in the 'Vibhas' (33.92%). 'Gaud Sarang' (40.81%) and 'Darbari Kanada' (41.66%) have difference of (0.85%) and maximum is noted in 'Control' (46.66%).

The percent number of individuals grown above average root length is recorded maximum in 'Darbari Kanada' (61.45%). 'Gaud Sarang' (44.89%) and 'Control' (46.66%) have difference of (1.77%) and minimum is seen in the 'Vibhas' (37.5%). The percent number of individuals grown below average root length minimum is recorded in 'Darbari Kanada' (38.54%) while maximum in the 'Vibhas' (62.5%).

Table 2- % Number of individuals grown above and below average Root-Shoot length

Sr. no.	Gharana	Raga	%Number of individuals grown above average shoot length (cm)	%Number of individuals grown below average shoot length	%Number of individuals grown above average root length (cm)	%Number of individuals grown below average root length
1	Kirana	<i>Vibhas</i>	58.24	41.75	53.84	46.1
2		<i>Gaud Sarang</i>	61.29	38.70	45.16	54.83
3		<i>Multani</i>	72.16	27.83	53.60	46.39
4		<i>Darbari Kanada</i>	56.25	43.75	54.16	45.83
5		Control	55.55	44.44	57.57	42.42
6	Jaipur	<i>Vibhas</i>	66.07	33.92	37.5	62.5
7		<i>Gaud Sarang</i>	59.18	40.81	44.89	55.10
8		<i>Multani</i>	56.70	43.29	49.48	50.51
9		<i>Darbari Kanada</i>	58.33	41.66	61.45	38.54
10		Control	53.33	46.66	46.66	45.55

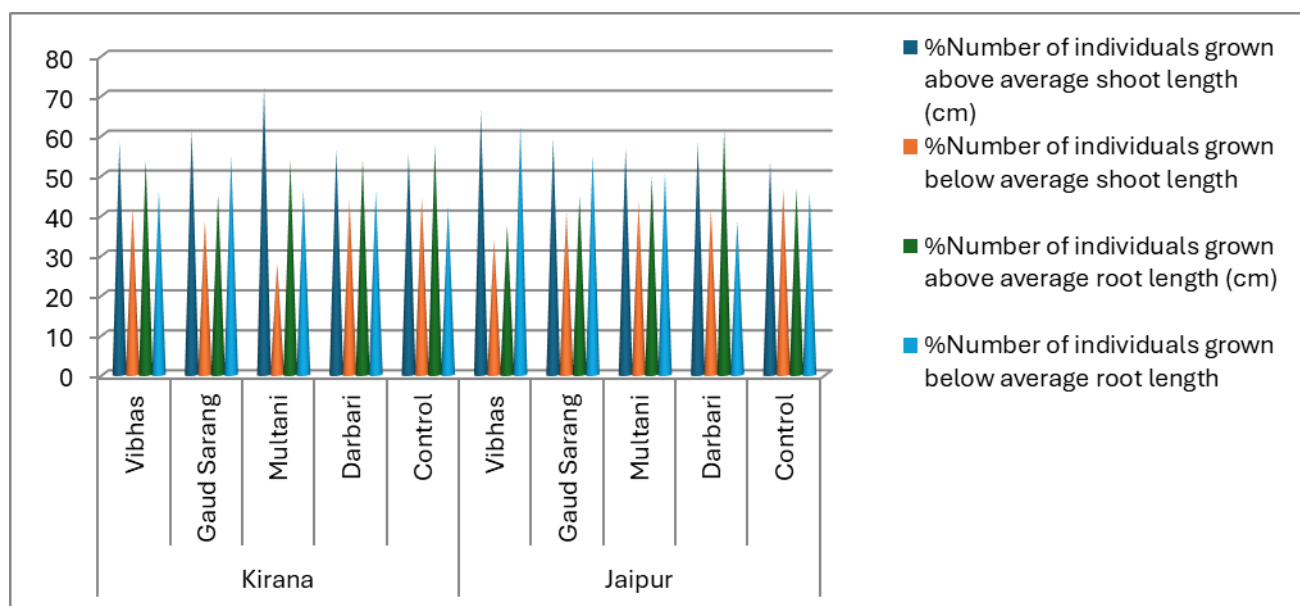


Figure 2 :Graphical - % Number of individuals grown above and below average Root-Shoot length

In 'Kirana Gharana' (Table- 3) 'Control' shows maximum % number of individuals grown above average total length (64.58%) and 'Vibhas' (61.53%) shows difference of (3.05%) Minimum recorded in 'Multani' (50.51%). The maximum % number of individuals grown below average total length is recorded in 'Multani' (49.48%). Raga 'Vibhas' (38.46%) and 'Control' (38.54%) shows nearly same results. Minimum is recorded in 'Vibhas' (38.46%).

The % number of roots grown above average root length observed maximum in 'Control' (57.57%). 'Vibhas' (53.84%) and 'Multani' (53.60%) are nearly same. Minimum recorded in 'Gaud Sarang' (45.16%). The % number of roots grown below average root length is recorded maximum in 'Gaud Sarang' (54.83%). 'Darbari Kanada' shows (45.83%). Difference of (0.24 %) recorded between 'Vibhas' (46.15%) and 'Multani' (46.39%) Minimum noted in 'Control' (42.42%).

The % number of shoots grown above average shoot length observed the maximum in 'Multani' (72.16%). Raga 'Darbari Kanada' (56.25%) and 'Vibhas' (58.41) shows difference of (2.16%). Minimum recorded in 'Control' (55.55%). % number of shoots grown below average shoot length found maximum in 'Control' (44.44%). Night Raga 'Darbari Kanada' (43.75%) and Morning Raga 'Vibhas' (41.75%) show difference of (2%) while minimum recorded in 'Multani' (27.83%).

In Jaipur Gharana, % number of individuals grown above average total length, 'Darbari Kanada' (63.44%) shows a maximum. 'Control' (56.66%) and 'Gaud Sarang' (56.12%) shows minor difference of (0.54%) while Minimum recorded in 'Multani' (52.57%). % number of individuals grown below average total length observed maximum in 'Multani' (47.42%). Raga 'Gaud Sarang' (43.87%) and 'Control' (43.33%) shows minor difference of (0.54%). Also 'Multani' (47.42%) and 'Vibhas' (46.42%) shows difference of (1%). Minimum number observed in 'Darbari Kanada' (39.78%).

% number of roots grown above average root length found maximum in 'Darbari Kanada' (61.45%). 'Multani' (49.48%) and 'Gaud Sarang' (44.89%) shows difference of (4.59 %). Raga 'Darbari Kanada' (61.45%) and 'Control' (54.44%) shows the difference of (7.01%). Minimum percent number of roots noted in 'Vibhas' (37.5%). % number of roots grown below average root length recorded maximum in 'Vibhas' (62.5%). Raga 'Gaud Sarang' (55.10%) and 'Multani' (50.51%) shows difference of (4.59%). Minimum number recorded in 'Darbari Kanada' (38.54%).

% number of shoots grown above average shoot length found maximum in 'Vibhas' (66.07%). Raga 'Darbari Kanada' (58.33%) and 'Gaud Sarang' (59.18%) shows difference of (0.85%) while minimum shown in 'Control' (53.33%). % number of shoots

grown below average shoot length maximum found in 'Control' (46.66%). Raga 'Gaud Sarang' (40.81%), 'Darbari Kanada' (41.66%) shows difference of (0.85%). Raga 'Multani' (43.29%) and 'Darbari Kanada' (41.66%) show the difference of (1.63%). Minimum number recorded in 'Vibhas' (33.92%). The

differences found between the ragas (0.85%) and (1.63%) are nearly in mathematical relation of twice.

In classical music treated cowpea, growth recorded to be increased in terms of chlorophyll content, relative water content, stomatal conductance, and gibberellin concentration. Classical music could be used to improve the growth and yield (Alavijeh et. al., 2016).

Table 3-% Number and % Root-Shoot growth above and below average

Sr. no.	Gharana	Raga	% Number of individuals grown above average total length	% Number of individuals grown below average total length	% Number of roots grown above average root length	% Number of roots grown below average root length	% Number of shoots grown above average shoot length	% Number of shoots grown below average shoot length
1	Kirana	Vibhas	61.53	38.46	53.84	46.15	58.41	41.75
2		Gaud Sarang	54.83	45.16	45.16	54.83	61.29	38.70
3		Multani	50.51	49.48	53.60	46.39	72.16	27.83
4		Darbari Kanada	58.33	41.66	54.16	45.83	56.25	43.75
5		Control	64.58	38.54	57.57	42.42	55.55	44.44
6	Jaipur	Vibhas	53.57	46.42	37.5	62.5	66.07	33.92
7		Gaud Sarang	56.12	43.87	44.89	55.10	59.18	40.81
8		Multani	52.57	47.42	49.48	50.51	56.70	43.29
9		Darbari Kanada	63.44	39.78	61.45	38.54	58.33	41.66
10		Control	56.66	43.33	54.44	45.55	53.33	46.66

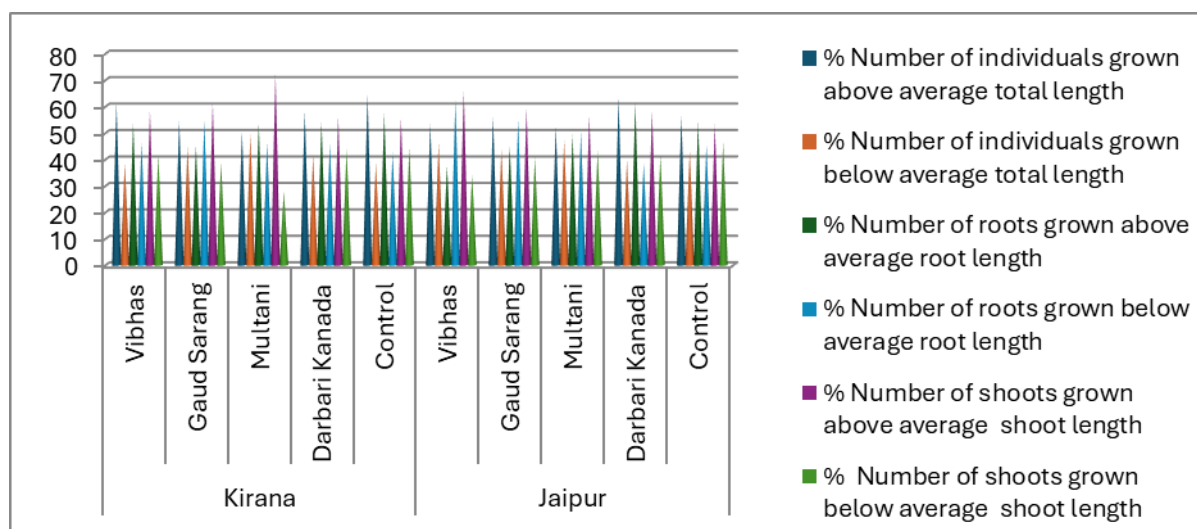


Figure 3: Graphical- % Number and % Root-Shoot growth above and below average

In 'Kirana Gharana' (Table- 4) Number of individuals grown above average shoot length observed maximum in 'Multani' (70). 'Control' shown (55) and minimum in 'Vibhas' (53). Number of individuals grown below average shoot length recorded maximum in 'Control' (44) followed by 'Darbari Kanada' (42), 'Vibhas' (38) and 'Gaud Sarang' (36). The minimum number recorded in 'Multani' (27).

Number of individuals grown above average root length noted maximum in 'Control' (57), 'Multani' and 'Darbari Kanada' are having same number (52). Minimum number recorded in 'Gaud Sarang' (42). In the number of individuals grown below average root length, maximum number shown in 'Gaud Sarang' (51). Raga 'Vibhas' and 'Control' have shown same number (42) which is minimum.

Number of individuals grown above average total length recorded maximum in 'Control' (62), 'Darbari Kanada' and 'Vibhas' (56) show same number in it. Minimum number in 'Multani' (49). Number of individuals grown below average total length recorded maximum in 'Multani' (48), 'Darbari Kanada' (40) and 'Gaud Sarang' (42) minimum in 'Vibhas' (35).

The growth rates and the number of the leaves of the plants exposed to the classical music noted to be higher than control. Classical music has a positive effect on plant growth (Akhoundnejad 2019).

In 'Jaipur Gharana' Number of individuals grown above average shoot length noted maximum in 'Gaud Sarang' (58) and Minimum in 'Vibhas' (37). Number of individuals grown below average shoot length recorded maximum in 'Multani' and 'Control' (42). 'Gaud Sarang' and 'Darbari Kanada' shown

same number (40) while minimum number recorded in 'Vibhas'(19).

Number of individuals grown above average root length found maximum in 'Darbari Kanada' (59). In the 'Control'(49) and in 'Multani'(48). Minimum found in 'Vibhas' (21). Number of individuals grown below average root length observed maximum in 'Gaud Sarang' (54) and minimum in 'Vibhas' (35).

Number of individuals grown above average total length noted maximum in 'Darbari Kanada' (59). 'Multani' and 'Control' shown same in number (51) and minimum number in 'Vibhas' (30). Number of individuals grown below average total length found maximum in 'Multani' (46) and minimum in 'Vibhas' (26). Plants grow faster when exposed to the music (Sharma et. al, 2014).

Table 4 - Number of individuals grown above and below average Root-Shoot length

Sr. No.	Gharana	Raga	Number of individuals grown above average shoot length	Number of individuals grown below average shoot length	Number of individuals grown above average root length	Number of individuals grown below average root length	Number of individuals grown above average total length	Number of individuals grown below average total length
1	Kirana	Vibhas	53	38	49	42	56	35
2		Gaud Sarang	57	36	42	51	51	42
3		Multani	70	27	52	45	49	48
4		Darbari Kanada	54	42	52	44	56	40
5		Control	55	44	57	42	62	37
6	Jaipur	Vibhas	37	19	21	35	30	26
7		Gaud Sarang	58	40	44	54	55	43
8		Multani	55	42	48	49	51	46
9		Darbari Kanada	56	40	59	37	59	37
10		Control	48	42	49	41	51	39

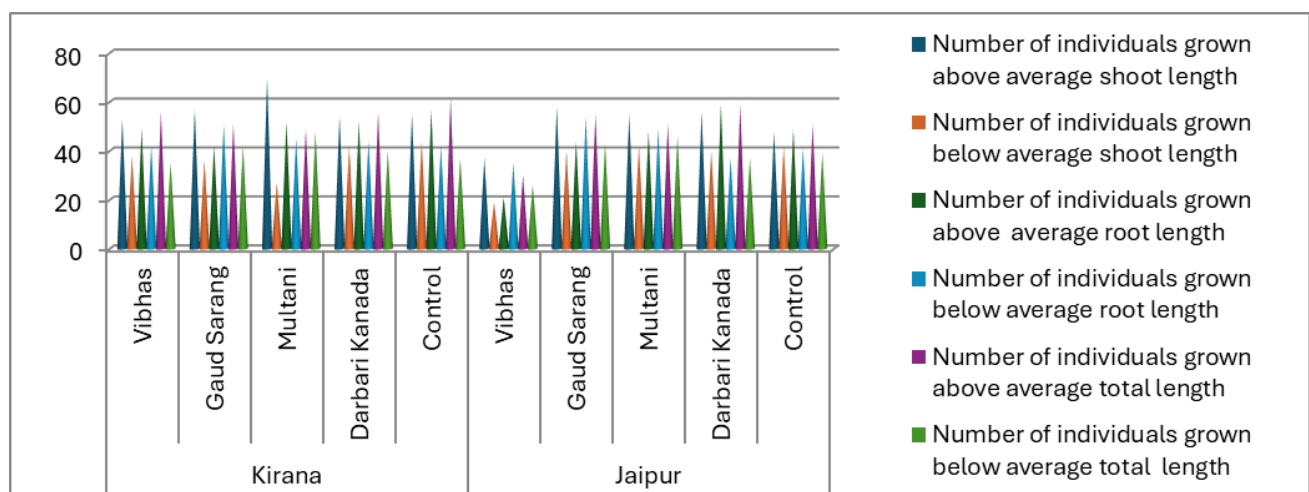


Table 4 Graphical- Number of individuals grown above and below average Root-Shoot length

The audible sound waves having specific frequency and intensity facilitated various growth stages of plant. The positive effect of audible sound stimuli including music observed on seed germination, development, and productivity and reduced quantity of fertilizers (Das 2023). Balsa plants initially treated with the classical music followed by raga, flute, violin, harmonica etc. it is observed that the plants grow 25-60% above the regional average (Singh 1962).

In '**Kirana Gharana**' (Table- 5) % Number of the individuals alive till the end of the experiment,

recorded maximum in 'Control' (99%) while minimum in 'Vibhas' (91%). Number of individuals died after the germination found to be (0%).

In '**Jaipur Gharana**' % Number of the individuals alive till the end of the experiment, recorded maximum in 'Gaud Sarang' (98%) and minimum in 'Vibhas' (56%). The major difference of (42%) is noted between 'Gaud Sarang' and 'Vibhas'. Number of individuals died after the germination found to be (0%).

Table 5- Post germination % mortality

Sr. no.	Gharana	Raga	% Number of seeds germinated	% Number of individuals alive till the end of experiment	% Number of individuals died after germination
1	Kirana	Vibhas	91	100	00
2		Gaud Sarang	93	100	00
3		Multani	97	100	00
4		Darbari Kanada	96	100	00
5		Control	99	100	00
6	Jaipur	Vibhas	56	100	00
7		Gaud Sarang	98	100	00
8		Multani	97	100	00
9		Darbari Kanada	96	100	00
10		Control	90	100	00

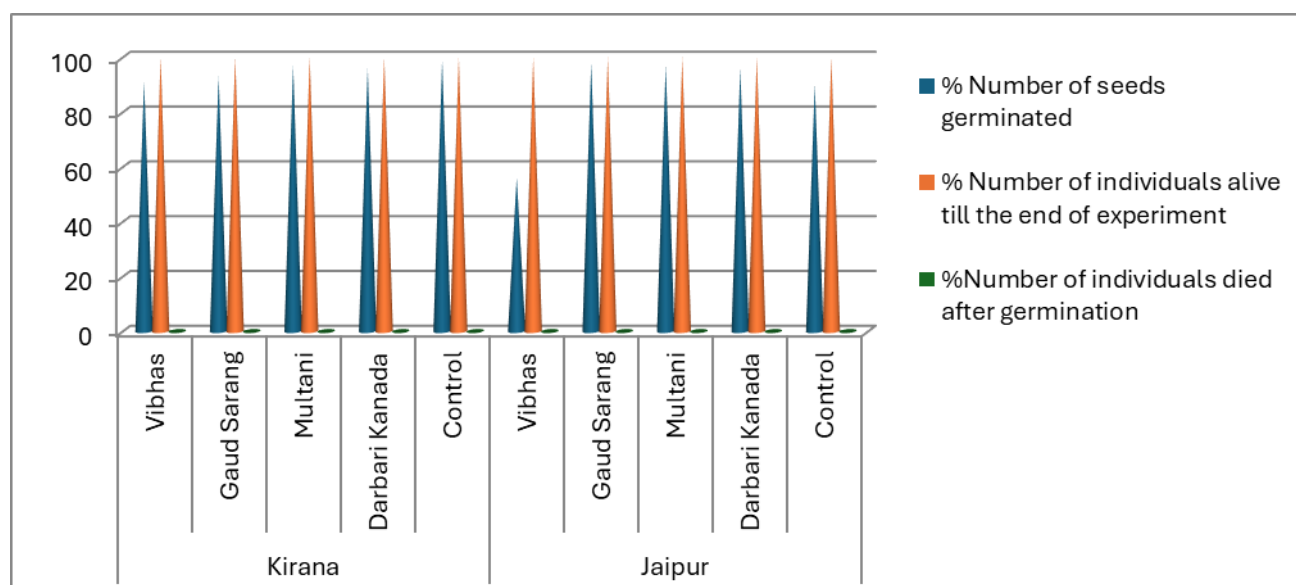


Figure 5: Graphical- Post germination % mortality

Plant metabolism is altered by music. Music is enjoyed and responded by plants according to kind and its wavelength. Hardcore musical vibrations maybe unfavourable to plants (Galston & Slayman, 1979). Indian classical music has significant impact on the plant growth and development (Kolhe and Oke 2025).

Plants can sense and respond to sound, vibration and respond to the rhythm, frequency and sound intensity of music by changing growth rate, morphology, leaf size, and shape etc. These findings suggest that music can have an impact on plant growth and development (Meng 2025). The music can increase seed germination, enhance crop productivity and also can reduce post germination death (Gajghate et. al., 2025).

CONCLUSION

The evening raga 'Multani' sung by both 'Gharana' maestros (Kirana and Jaipur) have shown strong and more positive effect on the germination and growth of *Cicer arietinum*, whereas the Morning Raga 'Vibhas' have strong and more negative effect in 'Jaipur Gharana'. The 'Raga Samay' has shown its influence on germination and growth. The treatment of Indian classical music can improve the percentage of germination and could prevent post germination mortality in *Cicer arietinum* L.

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