

Original Research Article

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EFFECT OF PLANETARY SOUND (EARTH & JUPITER) ON GERMINATION OF *CLITOREA TERNATEA* L. (ASIAN PIGEONWINGS) WHITE VARIETY

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ABSTRACT: Sound is an integral and unalienable part of living beings. It is less studied than physiological factors like light, temperature, moisture, and availability of nutrients. Sound affects all living organisms including plants and is perceived by them effectively. The reaction of the plants is according to the characteristics and variety of sounds it perceives, leading to either enhancement or suppression of the growth. The present research report is one of its kind and reported for the first time that the effects of planetary sounds on the plant, *Clitorea ternatea* L. (Asian pigeonwings) white variety's germination which was captured by Voyager satellite and was provided in a dosage manner for three hours per day with an hour break in between and over three months, continuously.

Keywords: Sound, *Clitorea ternatea* L., Voyager, Planetary Sound, plant growth.

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1. INTRODUCTION

What is sound?

Sound is a non-radiation mechanical longitudinal wave that travels through a medium that is air, liquid, or solid. The particles of the medium don't travel with the sound wave but vibrate to and fro at their original position and transfer the sound energy to the nearby molecules. The sound moves outward from the source thus creating a wave.

The sound wave is characterized by its properties like sound energy (dB) and frequency (Hz) along with timbre. The different songs are distinguished by these characters. Further, the spectrum of sound has been distinguished into ultrasound, audible sound, and infrasound which have different frequencies i.e., 2 to 18 megahertz [1], 20 Hertz to 20 Kilo Hertz [2], and 1.5 to 19.9 Hertz [3] respectively. Audible sound is further divided into four classes [2]. They are.

- a) Low-frequency sound waves ranged from 20 Hz to 200 Hz
- b) Medium-low frequency sound waves ranged from 200 Hz to 1 kHz.
- c) Medium-high frequency sound waves ranged from 1 kHz to 5 kHz
- d) High-frequency sound waves ranged from 5 kHz to 20 kHz.

The amount of sound energy in the wave arbitrates the sound wave amplitude and its traveling time.

Sound perceived by Plants:

Plants belong to a higher level of multicellular life forms that are exposed to various environmental factors in nature. These conditions guide the growth and development of plants, this occurs through the interaction of epidermal cells for communication with the environment. Thus, a set of interactions leads the plant to adapt to the circumstances favourably or unfavourably. Accordingly, the growth of plant cells and tissues occurs as a response to different physical stimuli. It has become an important field of study in cell biology [4]. Sound is an external stimulus that influences every aspect of plants [5],[6],[7],[8],[9]. The sound spreads information related to the surroundings and living beings perceive this information which may lead to communication through wave motion. Synchronized sound waves of planetary sound have been applied to plants at various growth stages. It is known to affect or stimulate seed germination, flowering, fruiting, and fruit ripening in several plants. Further, the exposure of plants to sound enhances the defense mechanism of plants against several biotic and abiotic agents. Sound waves can also act as a potent agent that can alter the cell cycle of the plant. Several works and observations showed that plants respond to different types of music. It can show both detrimental and stimulatory effects in its expansion and development. Music styles with hard-core vibrations cause major detrimental effects on plant growth and development [10].

Planetary Sound:

Planetary sounds available at NASA are the total of all the natural occurrences like bio-geochemical cycles and electromagnetic vibrations including radio waves and complex interactions of electromagnetic particles from solar winds, ionosphere, and planetary magnetosphere. All the active phenomena occur at a particular period. These phenomena include earthquakes, lightning storms, chemical rain, volcanic eruptions, rotation of the planetary body, and all the form of radiation occurring in the planet's outer atmosphere [11]. During the Voyager I, an instrument called "Plasmawave recorder" was installed. It converted all forms of radiation and waves to audible

sounds. It is a dedicated instrument to study various plasma waves and their interaction in deep space [12]. Sound waves transported through a medium via the mechanism of particle interaction are characterized as mechanical waves [13]. In nature, almost all living organisms are immersed in a variety of sound waves and interact with them [9]. The use of sound and music to improve the health of living organisms and scientific findings that back it up is indeed novel idea. Indeed, the beneficial and harmful effects of sound in terms of music were recognized by the ancient Greeks and Romans. Music, which is made up of sound waves with different frequencies and intensities, has been used for the treatment of illnesses, including neuropathy and depression [14]. Sir Jagadish Chandra Bose was an Indian plant physiologist and a prominent physicist. He concluded that the plants react to the attitude and the way of nurturing. He also discovered external physiological factors such as light, cold, heat, and noise influence the plant growth. Bose documented and published his finding in “Response in the Living and Non-Living”, published in 1902, and “The Nervous Mechanism of Plants” published in 1926 [15] [16]. Dr. TC Singh first studied the effects of music on plants in the 1950s [12]. In 1973, D. Retallack published a book titled, “The Sound of Music and Plant”, which described experiments involving plants and music. Music for about a thousand years has been a source of harmony for people. It is a soothing and tranquilizing form that is produced from the musical instrument. Music is a fine art of sound and is prearranged by people to express their feelings in a certain way [18]. Music certainly has many dimensions in stirring various physical, psychological, spiritual, and social stages of awareness. Currently, music is categorized as both positive and negative. Music that has valuable potential and inspires at emotional and spiritual levels and causes relaxing, calming, and healing effects is known as positive music whereas negative music induces negative emotions, irritation, bitterness, sadness, animosity, and terror [19]. Medicinal plants play a crucial role, as traditional herbal medicines for health care for the treatment of certain disorders and health-related conditions, irrespective of education and income level. Amongst them, Aparajita Plant, also known as *Clitoria ternatea* L., is an Ayurvedic herb that offers many benefits for health. It’s an important ingredient in many traditional Indian medicines and has been used for centuries for its medicinal properties. Aparajita has many other names, such as the Asian Pigeon Wings, White pea, Shankh Pushpa, Butterfly pea, and others. The botanical name of the flower is *Clitoria ternatea* L. [20]. The white variety of *Clitoria ternatea* L. is reported to have more medicinal properties than the blue variety [21]. *Clitoria ternatea* L. belong to Kingdom : Plantae (plantae, Planta, Vegetal, plants), Subkingdom: Viridiplantae (green plants), Infrakingdom: Streptophyta (land plants), Superdivision: Embryophyta, Division: Tracheophyta (vascular plants), tracheophytes, Subdivision: Spermatophytina (spermatophytes, seed plants, phanérogames), Class :Magnoliopsida, Superorder: Rosanae, Order : Fabales, Family: Fabaceae (peas, legumes), Genus: Clitoria L. (pigeonwings), Species: Clitoria ternatea L.(Asian pigeonwings), Variety: White, Blue [22]

Special Properties of the Aparajita: Aparajita is used in the 'Panchakarma' treatment of ayurveda. These treatments help to remove the disorders/dysfunctioning of the human body. The benefits of Aparajita are effective in the internal and external detoxification process of the body. It is beneficial for the nervous system which helps in the treatment of Rheumatoid Thyroid [22]. Distribution Habit and Habitat of *Clitoria Ternatea* - This plant originated in Latin America or Asia but is now naturalized in the semi-arid and sub-humid tropics of Asia, Africa, and Australia. The Aparajita plant is found in grassland, bush, open woodland, vegetation, and disturbed areas [22].

2. MATERIALS AND METHODS

Materials:

Alluvial soil was collected from the riverbank of Mahanadi River Basin at Jobra, Cuttack, (20°28.0199'N 85°53.7779'E) in December 2017. Similarly, coco peat was procured from Regional Plant Resource Center (RPRC), CRP Ekamra Kanana Road, IRC Village, Nayapalli, Bhubaneswar, Odisha 751015. This Alluvial Soil and Coco Peat was taken in a ratio of (4:6). It was mixed properly and packed into pots with the dimension of (L=33cm, B= 17cm, H=14cm).



Fig 1- Showing the type of pot the experiments were carried out in

Clitoria ternatea L. (White Variety), Aparajita seeds wild type were collected from "Simlipal National Bio-reserve Forest" at Mayurbhanj district (21°50'N 86°20'E) located in the northern part of Odisha, India. Due to the demand for further experiments a larger number of seeds amounting to three kgs was procured in the summer month of January 2018. These were checked, tested, and approved by a senior scientist at Regional Plant Resource Center (RPRC), CRP Ekamra Kanana Road, IRC Village, Nayapalli, Bhubaneswar, Odisha 751015.

For the germination study, 20 pots were taken and segregated into Control and Planetary sounds (Earth and Jupiter). In a single pot, *Clitoria ternatea* L. (White variety), Aparajita seeds were sowed into 3 rows and 5 columns. The total seed that was placed in a single pot was 15.

Philips SPA8140B/94 40 W 4.1 Channel music system was used to provide planetary sound to the batch setup for three hours a day with an hour's gap to be absorbed by the plant system. The sound of planet Earth and Jupiter was collected from NASA's official website [23]. The sound thus obtained from the NASA website was further analysed using Audacity[®] software version 3.2.3. It was found that Jupiter's sound has 44100 Hz and Earth's has 22050 Hz both in the Medium-high frequency sound wave ranges of audible sound



Fig 2a



Fig 2b

Figure 2(a &b) Showing *Clitoria terntea* L. (White variety) Aparajita placed in the pot in 5 Rows and 3 Columns

Methods:

Once the Aparajita seeds were planted, all the pots were marked and segregated into three batches (Control, seeds treated with Planet Earth's Sound, and seeds treated with Planet Jupiter's sound). A total of 20 pots per batch each containing 15 seeds was kept in a controlled environment with constant temperature ranging from 28°C at room temperature, humidity, and Light for 4 to 5 hours. Three identical rooms with the same dimensions were assigned to house the control, seeds growing under the influence of Planet Jupiter's sound, and seeds growing under the influence of Planet Earth's sound. The dimension of the house was 548.7 cm X 335.3 cm X 305 cm. It was placed on a table with dimensions 72 cm X 165 cm X 85.34 cm (LXBXH) in the center of the room. All the physiological conditions were maintained for all three setups (control and two experimental). The germination experiment was carried out for 20 days recording the number of seeds germinating per day, which was used to calculate the Germination percentage, Relativized percentage, Mean germination time, Mean germination rate, Coefficient of variation of germination time, Coefficient of the velocity of germination, Germination index, Uncertainty of germination process, Synchronization index, Time to 10% germination, Time to 25% germination, Time to 50% germination, Time to 75% germination, Time to 90% germination, Mean daily germination Percent, Peak value for germination and Germination value [24][25].

The values were calculated accordingly:

Germination percentage (GP)

Germination percentage is an estimate of the survivability of the population of seeds. The equation to calculate germination percentage is [26]:

$$GP = \frac{\sum_{i=1}^k n_i}{N} \times 100$$

n_i = number of seeds germinated in the i th time

N = Total number of seeds used

Relativized percentage (RV)

The germination percentage can be relativized by the following equation [27]:

$$R (\%) = \frac{AP}{HP} \times 100$$

AP= actual percentage

HP= highest percentage amongst the group of data

This standardization allows comparisons among treatments equivalent when the amount of dormancy broken varied.

Mean germination time (MGT)

Mean germination time is a measure of the average time for the seed to emerge or germinate. The following formula was used to calculate the mean germination time [28]:

$$\bar{t} = \frac{(\sum_{i=1}^k n_i t_i)}{(\sum_{i=1}^k n_i)}$$

$n_i t_i$ = The product of seeds germinated at interval i th with the corresponding time interval

n_i = number of seeds germinated in the i th time

Mean germination rate (MGR)

The mean germination rate is the reciprocal of the mean germination time as shown below [29].

$$\bar{v} = \frac{1}{\bar{t}}$$

\bar{t} = Mean germination time

Uncertainty of germination process (U)

The uncertainty of the germination process indicates the degree of uncertainty associated with the distribution of relative frequency of germination. Uncertainty is calculated using the following equation [30]:

$$U = \sum_{i=1}^k f_i \log_2 f_i$$

$$f_i = \frac{n_i}{\sum_{i=1}^k n_i}$$

f_i = Relative frequency of germination

Low values of uncertainty indicate frequencies with few peaks (i.e., germination more concentrated in time). A low value (towards zero) indicates more synchronized germination.

Synchrony of germination process (Z)

Evaluate the degree of overlapping certain demographic. The synchronization index produces a number if and only if there are two seeds finishing the germination process at the same time. It is calculated using the following formula [31]

$$Z = \frac{\sum_{i=1}^k C_{n_i,2}}{C_{\sum n_i,2}}$$

$$C_{n_i,2} = n_i(n_i-1)/2$$

$C_{n_i,2}$ = combinations of seeds germinated in the i th time, two by two.

n_i = number of seeds germinated in the i th time

The number Z equals one when all seeds sprout at the same time. And when Z is zero, at least two seeds may sprout simultaneously, and so on.

Coefficient of variation of germination time (CVt)

The coefficient of variation of the germination time is calculated by the following formula [32]

$$CVt = \frac{S_t}{\bar{t}} \times 100$$

S_t = standard deviation of germination time and calculated as

$$S_t = \sqrt{\frac{\sum_{i=1}^k n_i (t_i - \bar{t})^2}{\sum_{i=1}^k (n_i - 1)}}$$

\bar{t} = mean germination time

Samples with only one seed germinated do not have the value of this measurement because the divisor of variance of germination time is zero.

Germination index (GI)

The germination index is an estimate of the time (in days) it takes a certain germination percentage to reach its goal. It is expressed as [33]:

$$GI = \frac{\sum_{i=1}^k n_i}{t_i}$$

n_i = number of seeds germinated in the i th time

t_i = time taken for seeds to germinate at the i th count

Coefficient of the velocity of germination (CVG)

The coefficient of the velocity of germination was calculated using the following formula [34]:

$$CVG = \frac{\sum_{i=1}^k n_i t_i}{\sum_{i=1}^k n_i} \times 100$$

Time to 50% germination (T₅₀)

Time to 50% germination (T₅₀) indicates the time taken for half of the seeds to germinate. T₅₀ can be calculated using the following formula [35]:

$$T_{50} = \frac{t_i + \left(\frac{\sum_{i=1}^k n_i}{2} - n_i \right) (t_j - t_i)}{n_j - n_i}$$

In the above equation to find out the value of n_in_i and n_jn_j there is a need to look at the cumulative number of seeds germinated for which the condition is given below.

$$n_i < \left(\frac{\sum_{i=1}^k n_i}{2} \right) < n_j$$

n_i = nearest cumulative number of seeds germinated $C_{n_i} < \left(\frac{\sum_{i=1}^k n_i}{2} \right)$

n_j = nearest cumulative number of seeds germinated $C_{n_j} > \left(\frac{\sum_{i=1}^k n_i}{2} \right)$

Other time-related germination parameters like T₁₀, T₂₅, T₇₅, and T₉₀ were calculated using the same above formula by replacing $\frac{\sum_{i=1}^k n_i}{2}$ with $\frac{\sum_{i=1}^n n_i}{10}$, $\frac{\sum_{i=1}^k n_i}{4}$, $3 \frac{\sum_{i=1}^k n_i}{4}$ and $9 \frac{\sum_{i=1}^k n_i}{10}$ respectively.

Mean daily germination percent (MDG)

It represents the mean number of seeds germinated per day. This can also be defined as the number of seeds germinating daily relative to the maximum number of germinated seeds. It is calculated using the following expression [35]:

$$MDG = \frac{GP}{T_n}$$

GP = final cumulative germination percentage

T_n = total number of intervals required for final germination

Peak value (PV)

It is the accumulated number of seeds germinated at the point on the germination curve at which the rate of germination starts to decrease. It is computed as the maximum quotient obtained by dividing successive cumulative germination values by the relevant incubation time [36].

Germination value (GV)

Germination value is calculated by combining both speed and completeness of germination into a composite score as described by Czabator [37].

$$GV = MDG \times PV$$

MDG = mean daily germination

PV= peak value or largest quotient obtained when all of the cumulative germination percentages were divided by the respective time interval.

Statistical Tools

A minimum of three replicates were conducted for each experimental group, and the results were calculated as mean \pm standard deviation. Different letters (a–c) among the group denote the significant differences between the mean at $p < 0.05$ using one-way analysis of variance (ANOVA), Tukey's HSD test, and LSD test using R-statistical tool version 4.2.2 and R-Studio version 2023.03.0-386.

3. RESULTS AND DISCUSSION

Table 1- Estimation of "Relativized Percentage of Germination (RP), Mean Germination Time (MGT), Mean Germination Rate (MGR) and Coefficient of Variation of Germination Time (CVt)" of different treatments. Different letters (a–c) among the group denote the significant differences between the mean at $p < 0.05$ using one-way analysis of variance (ANOVA), Tukey's HSD comparison test, and LSD test.

Treatment	Relativized Percentage (RP) [%]	Mean Germination Time (MGT) [day]	Mean Germination Rate (MGR) [day ⁻¹]	Coefficient of Variation of germination time (CVt) [%]
Control	78.780 \pm 0.192 ^c	13.326 \pm 0.083 ^a	0.075 \pm 0.0004 ^c	28.003 \pm 0.244 ^b
Seeds treated with planet Jupiter's sound (PJS)	98.000 \pm 2.645 ^a	9.130 \pm 0.055 ^c	0.109 \pm 0.0009 ^a	35.411 \pm 0.380 ^a
Seeds treated with planet Earth's sound (PES)	92.560 \pm 3.656 ^b	10.522 \pm 0.104 ^b	0.095 \pm 0.0006 ^b	34.329 \pm 0.972 ^c

In Table 1, the Relativized percentage (RP) was best in seeds treated with planet Jupiter's sound followed by seeds treated with planet Earth's sound as compared with the control. Relativized percentage (RP) establishes a level comparison between treatments and thus it establishes that the seeds broke dormancy and germinated better due to planetary sounds (Fig 3). The mean germination time (MGT) was reduced to 9.13 days for plants treated with planet Jupiter's sound followed by 10.52 days for plants treated with planet Earth's sound and finally 13.22 days for control plants (Fig 4). Similarly, the mean germination rate (MGR) was highest at about 0.109 days for plants treated

with planet Jupiter’s sound followed by 0.095 days for plants treated with planet Earth’s sound as compared with control 0.075 days (Fig 5).

The coefficient of variation of germination time (CVt) dictates the uniformity of germination and permits collating the data irrespective of the magnitude of mean germination time [38]. The CVt between control and seeds exposed to planetary sound differs significantly as observed in Table 1. CVt rose to 35.41 % and 34.32 % but the control remained at 28.00 % (Fig 6).

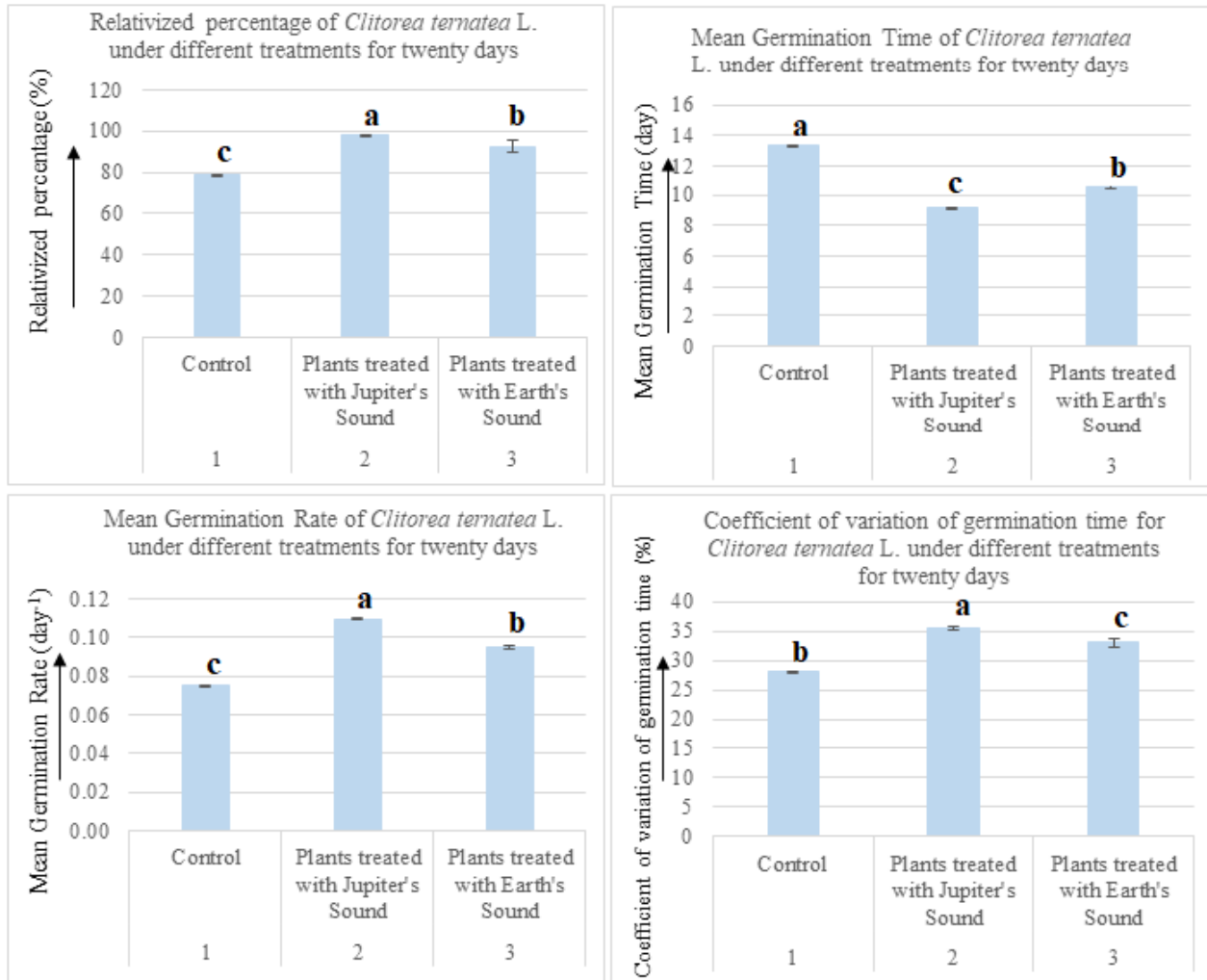


Fig 3, Fig 4, Fig 5 & Fig 6 depict the Relativized percentage, Mean Germination Time, Mean Germination Rate, and Coefficient of variation of germination time for all the treated *Clitorea ternatea* L. (White variety) seeds. Different letters (a–c) among the group denote the significant differences between the mean at $p < 0.05$ using one-way analysis of variance (ANOVA), Tukey’s HSD comparison test, and LSD test.

Table 2- Estimation of “Germination percentage (G%), Uncertainty of Germination Process (U), and Synchronization Index (Z) and Mean Daily Germination Percent (MDG)” of different treatments. Different letters (a–c) among the group denote the significant differences between the mean at $p < 0.05$ using one-way analysis of variance (ANOVA), Tukey’s HSD comparison test, and LSD test.

Treatment	Germination percentage (G%) [%]	Uncertainty of germination process(U) [bit]	Synchronization Index (Z)	Mean Daily Germination (MDG) [%]
Control	78.778±0.193 ^c	2.657±0.032 ^b	0.160±0.002 ^b	3.938±0.009 ^c
Seeds treated with planet Jupiter’s sound (PJS)	98.000±2.646 ^a	2.630±0.025 ^b	0.169±0.002 ^a	4.627±0.182 ^b
Seeds treated with planet Earth’s sound (PES)	92.556±3.656 ^b	2.770±0.048 ^a	0.154±0.004 ^b	4.627±0.182 ^b

Similarly in Table 2, the Germination percentage (GP) was higher at 98 % for seeds treated with planet Jupiter’s sound and next to 92.56 % for seeds treated with planet Earth’s sound. The control had the least GP at 78.78 % (Fig 7). These findings hold for seeds treated with sounds having higher frequency [39]. It has been found that seeds exposed to planetary sounds didn’t have much significant difference in values of the Uncertainty process (U) (Fig 8). It has been suggested that low values of Uncertainty of the germination process (U) indicate frequencies with few peaks and have focused germination over the period. Hence all the treatment values being closer to zero indicates coordinated germination [40,41]. The low values Synchronization Index (Z) across the experimental setup plants suggest that more than two seeds in the three groups finished the germination process at the same time. This verifies our experimental setup (Fig 9) [42]. Mean Daily Germination (MDG) was highest for seeds treated with Jupiter’s sound than for seeds treated with Earth’s sound and least for control (Fig 10).

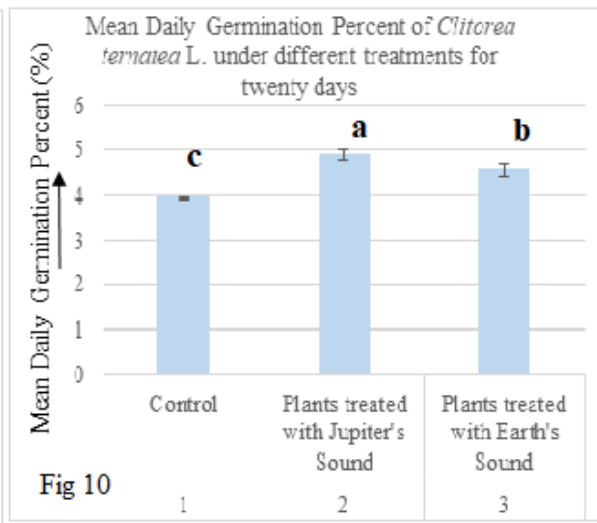
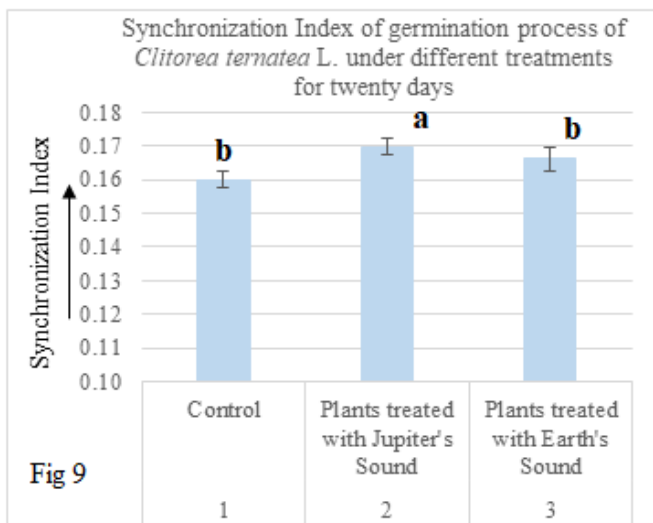
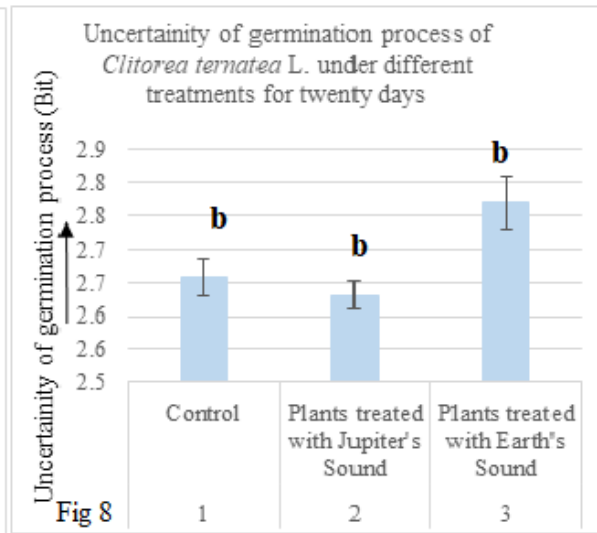
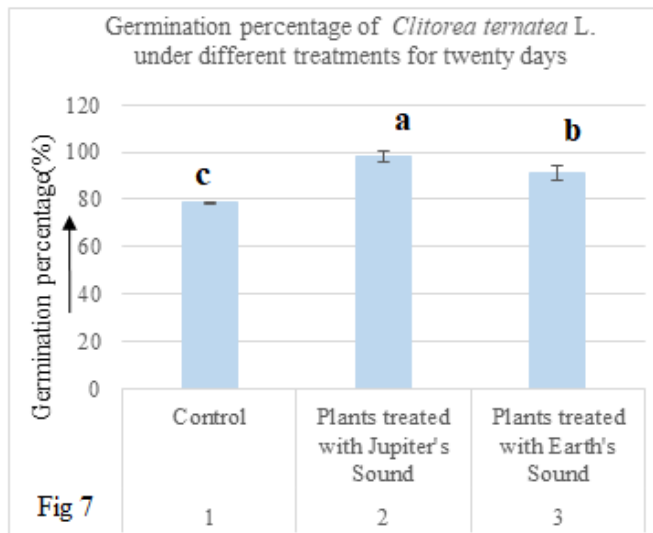


Fig 7, Fig 8, Fig 9 & Fig 10 depict the Germination percentage, Uncertainty Germination process, Synchronization Index, and Mean Daily Germination for all the treated *Clitorea ternatea* L. (White variety) seeds. Different letters (a–c) among the group denote the significant differences between the mean at $p < 0.05$ using one-way analysis of variance (ANOVA), Tukey’s HSD comparison test, and LSD test.

Germination Index (GI) specifies the optimum percentage of germination occurring at a particular period. In Table 3, a significant difference between experimental and control can be observed for GI (Fig 11). Seeds treated with Jupiter’s sound had the highest value of 37.10 days followed by seeds treated with Earth’s sound with 30.16 days. The control had only 19.23 days. The GI emphasizes both the percentage of germination and its speed. A higher GI value states a higher percentage and a higher rate of germination [42]. The peak value of germination describes the germination rate of a seed group and its quality [43]. The treatment of planetary sounds on seeds increased their quality to germinate. The order of peak value is 6.93, 5.75 and 4.18 for seeds treated with Jupiter’s sound followed by seeds treated with Earth’s sound and lastly control seeds, respectively (Fig 12). Further,

Peak Value determines Germination Value (GV) as it is defined as an index of combining speed and completeness of seed germination [39]. Thus, the higher the value greater is germination process and almost the whole seed lot was experimented on germinated. Seeds treated with the Jupiter sound had a value of 34.01 whereas seeds treated with planet Earth’s sound had a value of 26.65. Both the experimental seed lots were having higher values when compared with the control which was at 16.46 (Fig 13). The speed of germination is reflected by the coefficient of the velocity of germination time (CVG). Seeds treated with planet Jupiter’s sound have a larger value than seeds treated with planet Earth (Fig 14). Control seeds had the least value. This suggests that seeds treated with Jupiter’s sound were found to be faster in germinating.

Table 3- Estimation of “Germination Index (GI), Peak Value of Germination (PV), Germination Value (GV), and Coefficient of Velocity of Germination (CVG)” of different treatments. Different letters (a–c) among the group denote the significant differences between the mean at $p < 0.05$ using one-way analysis of variance (ANOVA), Tukey’s HSD comparison test, and LSD test.

Treatment	Germination Index (GI) [day]	Peak Value of germination (PV) [day ⁻¹]	Germination Value (GV)	Coefficient of Velocity of germination time (CVG) [%]
Control	19.238±0.113 ^c	4.180±0.043 ^c	16.466±0.145 ^c	7.504±0.047 ^c
Seeds treated with planet Jupiter’s sound (PJS)	37.108±1.086 ^a	6.937±0.284 ^a	34.016±2.235 ^b	10.952±0.066 ^a
Seeds treated with planet Earth’s sound (PES)	30.166±1.260 ^b	5.753±0.264 ^b	26.659±2.235 ^b	9.504±0.095 ^b

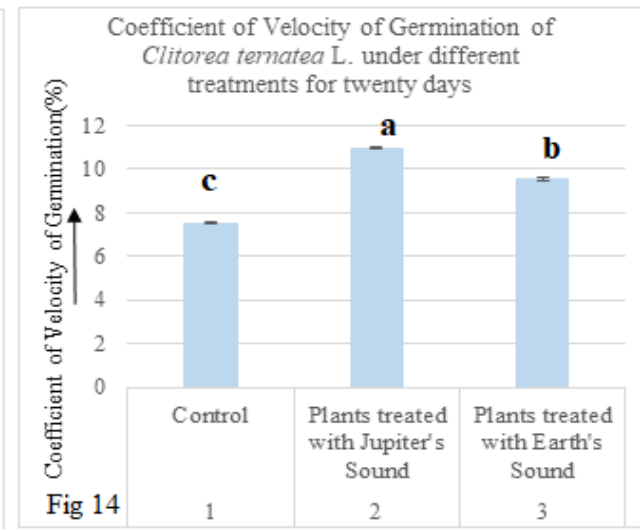
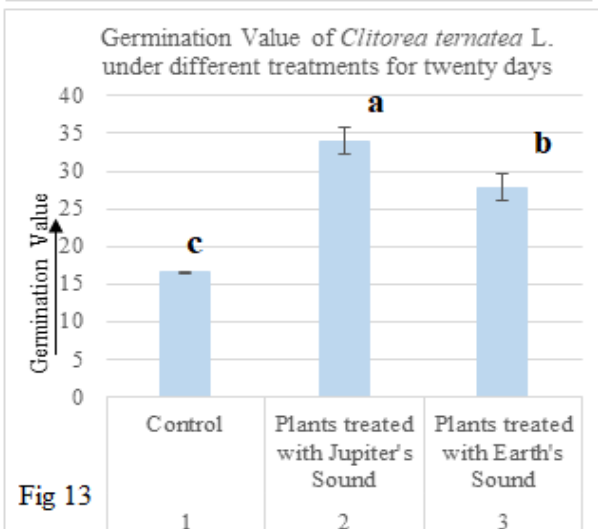
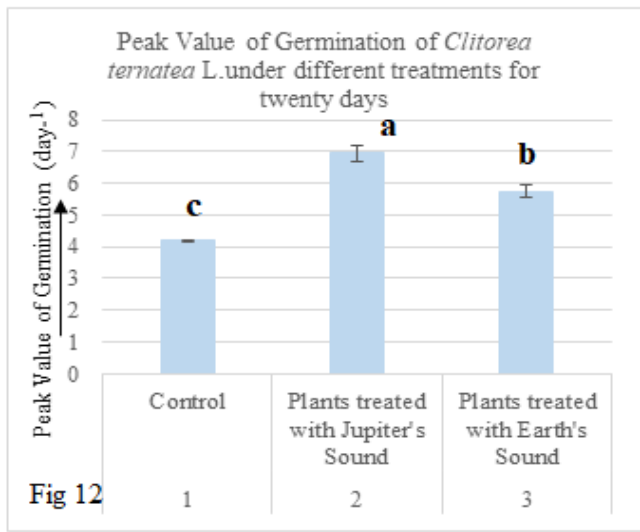
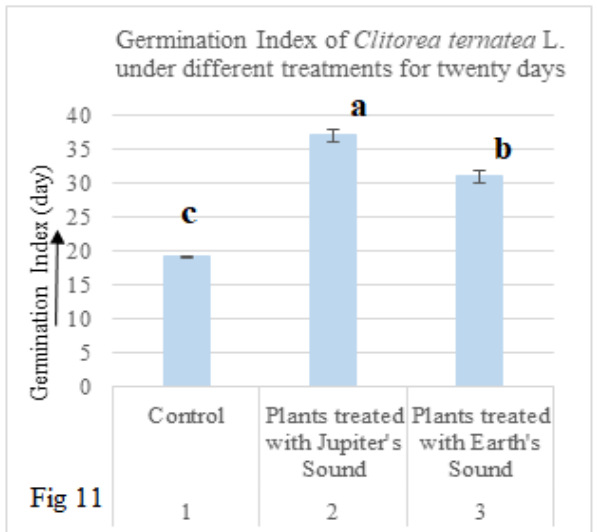


Fig 11, Fig 12, Fig 13 & Fig 14 depicts the Germination Index, Peak Value of germination, Germination Value, and coefficient of the velocity of germination time for all the treated *Clitorea ternatea* L. (White variety) seeds. Different letters (a–c) among the group denote the significant differences between the mean at $p < 0.05$ using one-way analysis of variance (ANOVA), Tukey’s HSD comparison test, and LSD test.

Table 4- Description of “Time to T₁₀, T₂₅, T₇₅, and T₉₀ germination” of differently treated *Clitorea ternatea* L. seeds

Treatment	T ₁₀ (Day)	T ₂₅ (Day)	T ₅₀ (Day)	T ₇₅ (Day)	T ₉₀ (Day)
Control	7±0.11	9±0.09	12±0.07	15±0.09	18±0.00
Seeds treated with planet Jupiter’s sound (PJS)	4±0.02	5±0.01	8±0.07	11±0.11	13±0.06
Seeds treated with planet Earth’s sound (PES)	5±0.06	7±0.14	9±0.13	12±0.11	15±0.10

Table 4 showed that planetary sound-treated seed germinates much faster than the control. It is observed that from germination to maturation, RONS are engaged in several seed processes [41]. RONS is used in a variety of signalling processes throughout the plant life cycle, including the emergence of dormancy during seed germination [42]. Our experiments will lead to determining whether this hypothesis holds for us in the future.

Discussion

Germination percentage (GP) and Relativized percentage (RP) of plants growing under the influence of sound from Jupiter planet were found to be better than control and plants growing under planet Earth sound. Similarly, Mean Germination Rate (MGT) was less for planetary sounds and more for Mean Germination Rate (MGR). The findings are by the general observation as MGT and MGR are inversely related [39]. The Coefficient of Variation of germination time (CV_t), Coefficient of Velocity of germination (CV_G), Germination Index (GI), Uncertainty germination process (U), Synchronization process (Z), Mean Daily Germination (MDG), Peak Value of germination (PV) and Germination Value (GV) were also found to be better for plants treated with planetary sound as compared with control. Among the experimental lot, plants under planet Jupiter’s sound had the most suited for the germination process followed by plants treated with planet Earth’s sound. Further analysis like biochemical, histological, and molecular work needs to be done to reiterate our hypothesis that planetary sound enhances the growth and development of the medicinal plant *Clitorea ternatea* L. white variety.

4. CONCLUSION

Our finding supports the notion that sound from planet Jupiter (4410 Hz) was better at germination than the sound from planet Earth (22040 Hz) as well as control. This is in accord with previous findings [43],[44],[45]. In summary, all the plants growing under sound were growing better. It can also be inferred that sound captured from satellites like Voyager I and II, which has crossed solar system, from distant and unknown planets may be analysed to correlate with presence of water. As the planet contains water, its chances to harbour life of its own increases many folds. Scientists can further investigate using our approach to discover new planets and places for humans to transmigrate

in the near future.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No Animals/Humans were used for studies that are base of this research.

CONSENT FOR PUBLICATION

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CONFLICT OF INTEREST

As all the authors have equal contribution both towards the experimental works and in preparation of this write ups for publication, there is no conflict of interest amongst the authors and co- authors regarding the publication of this original research works.

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