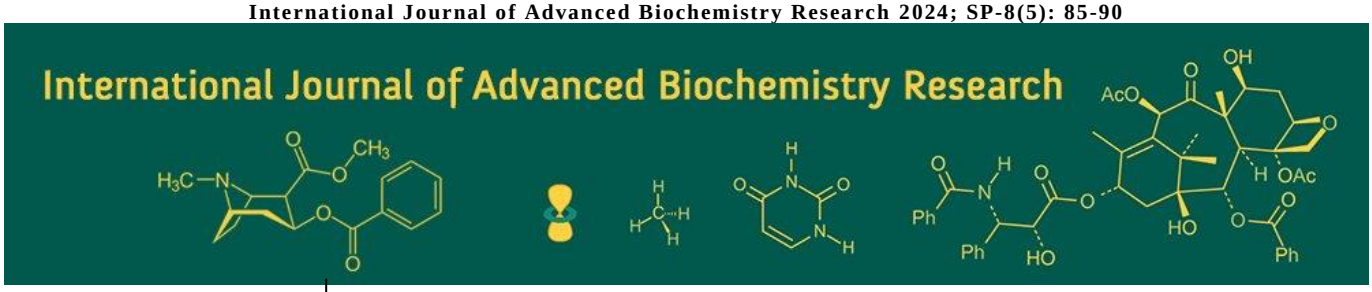

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Effect of temperature on seed germination of bird of paradise (*Strelitzia reginae*)

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Abstract
The first experiment consisted of exposing seeds to five different temperatures i.e., 20 ºC/30 ºC -16/8 hrs., Constant 30 ºC for 24 hrs., constant 35 ºC for 24 hrs., 25 ºC/35 ºC for 16/8 hrs. and control (room temperature-25±2 ºC) in Complete Randomized Design with four replications. Significant differences were observed among the treatments for mean germination percentage, days taken for initiation of germination, days taken for fifty percent germination, days taken for seventy percent germination and on growth parameters. The mean germination percentage and growth parameters were found to be maximum in the temperature 20 ºC /30 ºC -16/8hrs.

Keywords: temperature, seed, bird, paradise, *Strelitzia reginae*

Introduction
Bird of Paradise (*Strelitzia reginae* L.) is a perennial monocotyledonous plant belonging to the family Strelitziaceae, with a diploid chromosome number, 2n=22. Strelitzia is a genus of five species native to South Africa. The genus is named after the duchy of Mecklenburg-Strelitz, birthplace of Queen Charlotte of the United Kingdom. A common name of the genus is bird of paradise flower / plant, because of a resemblance of its flowers to birds-of-paradise. In South Africa it is commonly known as crane flower and is featured on the reverse of the 50 cent coin. It is the floral emblem of the City of Los Angeles; two of the species, *Strelitzia nicolai* and *Strelitzia reginae* are frequently grown as house plants. The herbaceous plant derives its common names from the unique flower it bears, which resembles a brightly colored bird in flight. The leathery leaves are held upright on stiff leaf-stalks and are about 6 inches wide and 18 inches long. The plant forms a 3to 5 foot-tall clump that can be used as a focal point in landscaping or in mass plantings. The evergreen leaves of bird of paradise do not drop from the plant, which makes it an excellent addition around pools or wherever leaf shedding is an aesthetic/ maintenance problem. Bird-of-paradise makes an attractive landscape plant throughout Florida in the United States, although it requires protection from the cold in the northern part of the state. The plant can tolerate temperatures as low as -4.4°C for a short time; however, freezing temperatures damage developing flower-buds and flowers. To ensure flower production in colder climes, bird of paradise can be grown in containers that can be moved indoors during freezes. The showy bloom is actually a combination of blue petals and orange sepals that emerge from a beak like bract (modified leaf). Blooms appear intermittently most of the year. Healthy, mature plants can produce as many as three dozen flower spikes a year, which can last up to two weeks when cut. The genus comprises \ five species, *viz*., S. reginae, S. *augusta*, S. *kewensis*, S. alba and S. nicolai. Among these, S. reginae is very popular flowering species, growing to a height of 90cm with a leaf stalk about 45cm long. The orange and purple flower is very brilliant, emerging from a purplish spathe on the stem. The plant has a striking appearance even when not in flower, due to its large, glaucous leaves that resemble those of Heliconia plants. In recent years, some unexploited cut flower crops have been gaining popularity because of their attractive size, form, colour and keeping quality. Among them, bird of paradise has its own importance both in the domestic and international markets due to its attractive, remarkably shaped crested head of bird, and a combination of orange and purple coloured flower clusters. Bird of paradise is used for flower arrangement.

It occupies a place of pride in gardens and is an important choice for landscaping. It is also grown in the backyard for mass effect. The leaves of bird of paradise are also used as a filler material in flower arrangements. Bird of paradise, being an evergreen perennial herbaceous plant, is grown in regions of moderate sub tropical climate and is cultivated in many parts of the world. Countries growing it majorly on a commercial scale are USA, Israel and South Africa. In the US, at present California is the largest producer, followed by Hawaii (Singh, 2016 and USDA, 2003) [1]. Jamaica, Guatemala and other Caribbean countries export it in small quantities. In India, these flowers are grown in the Southern region in places that enjoy a tropical climate, *viz*., Andhra Pradesh, Karnataka, Tamil Nadu, Maharashtra and Kerala. Propagation of Strelitzia species by seeds is a slow process. Fresh seeds from which the orange aril has been removed must be used, and preferably sown in spring or early summer. Seeds kept under suitable conditions germinate in six to twelve weeks (Hensley *et al*., 1998; Notten, 2002; Burgess, 2004) [2, 3, 4]. Seedling establishment can take about six months, producing one plant per seed (Sayers, 2007). Mature plants start flowering only fourth to seventh years onwards (Kantharaju *et al*., 2008) [7]. *Strelitzia reginae* is propagated either by division of naturally developed branches known as 'fans', or, by seeds. Vegetative propagation by division is limited by a low rate of multiplication, at 0.5–1.5 divisions per branch per year (Van de Pol and van Hell, 1988) [8]. Branching originates in the division of the apical dome, with an absolute absence of branching from axillary buds. Propagation by seeds is undesirable due to genetic variation, besides its juvenility. Therefore, induction of branching to increase multiplication rate of Strelitzia by eliminating apical dominance was one of the purposes of this study. Selected plants are excavated and divided into 'fans'. After shortening the roots to 20cm, the fans are planted in containers and left for recovery/ root regeneration. Then, the apex is reached by a triangular excision of a part of the plant with a transverse cut 8–12mm above the basal plate throughout the basal leaf sheaths, keeping the leaves in contact with roots. Thereafter, the apex is removed. After 2–6 months of this, lateral sprouts develop, varying in number from 2 to 30 per fan (depending upon the age and size of the fan). To obtain shoots with roots, most of the old roots are removed; during the next 6 months, newly-formed laterals rooted and can be divided into individual plants. The total period for the sequential processes takes about a year. Due to slow growth and low multiplication rate, *in vitro* culture is an alternative method that can be applied to increase multiplication rate under controlled conditions. However, despite attempts made on *in vitro* propagation, no successful mass propagation has been achieved using tissue culture. Major constraints for *in vitro* culture of this species are (i) oxidative browning due to the presence of high levels of phenolic compounds in plant tissues (Ziv *et al*., 1983) [9] and (ii) the recalcitrant nature of the plant. Therefore, there is a need to determine the effect of various limiting factors on seed germination and *in vitro* culture and optimise culture conditions in this high value ornamental crop. Strelitzia, as a species, is thus highly sought-after as cut flower and is of significant commercial value. Despite the high demand, it has not spread wide due to production constraints and is one of the few important cut flower plants for which no uniform cultivars are available. Conventional methods of propagation are very slow due to the plant's low rate of multiplication. Despite the plant's commercial importance, a method for micro propagation has not yet been established. Large-scale propagation and cloning is, therefore, needed to exploit the potential of this flower crop. Attempts at tissue culture in this plant have failed. Wounded tissues release polyphenolic compounds which are detrimental to further development of the explant. Only partial success (that too, with a low rate of multiplication), has been achieved. This study explores possibilities of developing an *in vitro* method for successful propagation of Strelitzia spp. Tissue culture can be more promising than other, conventional methods of multiplying Strelitzia. A reliable and advanced propagation / cloning method would greatly contribute to overcoming limitations this species poses to the horticultural and landscaping industry worldwide (Ziv and Halevy, 1983) [9]. Despite the plant's commercial importance, a reliable method for micro propagation is not yet available. In several investigations, only partial success and a low rate of multiplication were obtained, indicating major problems with growing and multiplying this plant *in vitro*. Further, successful regeneration from zygotic embryo explants has not been reported, suggesting that protocols developed so far have not been efficient with respect to growth and large scale multiplication of this plant.

Materials and Methods

The present investigation on 'Study on multiplication of Bird of Paradise (*Strelitzia reginae* L.) by conventional and biotechnological approaches' was conducted at ICAR-Indian Institute of Horticulture Research, Hessaraghatta, Bengaluru, during 2016-2017. The experimental site is located at an altitude of 890m above mean sea level, 13°N latitude and 17°37' E longitude. In this chapter, the material used for research and methods followed are discussed.

Effect of temperature

Planting material One year old mature seeds of*Strelitzia reginae* (Bop-15) were collected from plants grown at ICAR-Indian Institute of Horticulture Research, Bangalore.

Preparation of planting material Five hundred seeds were surface-sterilized in a solution of Bavistin @ 5g/ 250ml water for 15 min and, then, rinsed twice in sterile distilled water. These were placed in moist paper towels that were then rolled and kept in a germination chamber or incubator for germination (here, twenty paper towels had been immersed in water for five minutes and dried for ten minutes before use).

Data collection and analysis Data were collected at weekly intervals on (i) Seed germination rate (radicle emergence), (ii) Days taken to 50% germination, (iii) Days taken to attain 70% germination, (iv) Mean germination percentage, (v) Plant height (cm) at 3 months after sowing, (vi) Plant girth (cm) at 3 months after sowing, and (vii) Number of leaves per plant at 3 months after sowing. Based on visual scoring/ observations, data were collected and analyzed for statistical significance, using Complete Randomized Design (CRD).

Treatment details

Treatment 1: Incubation at 20 °C/30 °C for 16/8 h, respectively In all, 100 seeds were selected and placed in an incubator at 20 °C and 30 °C for 16 and 8 hours, respectively. These were divided into 25 seeds per replication.

Treatment 2: Constant 30 °C for 24 h A total of 100 seeds were selected and placed in an incubator at a constant temperature of 30 °C for 24 h. These too were divided into 25 seeds per replication.

Treatment 3: Constant 35 °C for 24 h A total of 100 seeds were selected and placed in an incubator at a constant temperature of 35 °C for 24 h. These too were divided into 25 seeds per replication.

Treatment 4: 25 °C/35 °C for 16/8 h, respectively 100 seeds were selected and the selected seeds were kept in incubator at 25 °C and 35 °C for 16h and 8h, respectively. These too were divided into 25 seeds per replication.

Treatment 5: Control (Room Temperature – 25±2 °C) 100 seeds were selected and placed at room temperature (i.e., ambient conditions). These too were divided into 25 seeds per replication.

Design: Complete Randomized Design 3.1.6 Replications: 4 (8 samples per replication).

Results and Discussion

Effect of Temperature

Days taken to first germination: The data related to Days taken for first germination of Bird of paradise as influenced by different temperature treatments was recorded and the data was presented in table 1. Days taken for first germination were significantly different between the various temperatures. Number of days taken for first germination ranged from 16 to 20 days. The first sign of germination was observed in T_4 (25 °C/35 °C for 16/8 hrs.) at 16 days followed by T_5 (control) 16.5 days. However maximum number of days taken for first germination was recorded with T_2 (20.00). Whereas, no sign of germination was observed in T_3 (Constant 350 °C for 24 hrs.). Germination begins when dry seeds are hydrated with water that results in embryo expansion followed by the higher physiological activity of the seed (Finch-Savage and Leubner Metzger, 2006) [10].

Days taken to 50% germination the results of Days taken to 50% germination is presented in table 2. Days taken for fifty percent germination significantly ranged from 26.51 days to 36.02 days. The lower number of days taken for 50% of germination was recorded in T_5 (Control) within 26.51days and followed by 29.51 in T_1 (200 C /300 C -16/8 hrs.) whereas, there was no sign of germination in T_3 (Constant 350 C for 24 hrs.). However, maximum number of days taken for 50% of germination (36.02 days) was recorded with T_4. The results of the present investigation revealed that the control (T_5) showed earlier germination compared to other treatments. This might be due to the prevailing of the optimum weather conditions during the experimental period (Barbosa *et al*., 2005) [11]. The seeds of *Strelitzia reginae* reached up to 30% germination at 25 °C as compared to 15% germination at 30 °C and 11% germination at 20 °C (Barbosa *et al*., 2005) [11]. 4.1.3 Days taken for 70% germination Days taken for 70% germination varied significantly with different temperature levels, the data shown in Table 2. It was evident from the data that minimum days taken for 70% of germination observed (37.12) in Control (T_5) and followed by 41.31 days in 200 C / 300 C -16/8 hrs. (T_1). While the highest number of days was recorded (50.41) in T_4. Till there was no germination recorded at constant 350 C temperature. 4.1.4 Mean germination percentage The percentage of mean germination of *Strelitzia reginae* seeds recorded in different temperatures were recorded and presented in Table 3. Days taken for mean germination differed significantly due to effect of different temperatures. Mean germination percentage ranged from 0% (T_3) to 75.03% (T_1). Highest mean germination percentage (75.03%) was recorded in T_1 (200 C /300 C -16/8 hrs.) followed by 70% recorded in T_5 (control). No seed germination was seen in T_3 (Constant 350 C for 24 hrs.). At high temperature the enzymes catalyzing germination process become inactive. Due to the temperature dependency of hormones and enzymes, high temperature will significantly affect germination. The bird of paradise seeds require a particular temperature to initiate germination and temperature regimes vary from species to species. The temperature of 25 °C allows the expression of the physiological potential of seeds *Strelitzia reginae*. The results got support from the Notten (2002) [3] and Winter (2004) [12] and Barbosa *et al*. (2005) [11]. A constant temperature of 25 °C is reported as most suitable for *in vivo* seed germination of S. reginae and S. juncea as low temperatures retard or slows down germination Notten (2002) [3]. As above mentioned results under T_1 (20 °C /30 °C -16/8 hrs) treatment, highest mean percentage of germination was found compared to other treatment and lowest percentage was observed T_4. Same results observed in seeds of S. juncea showed higher germination (70%) *in vivo* when exposed to total darkness with germination *in vivo* as compared to red and white light treatments by Roumiana Vassileva Nikolova *et al*. (2013) [13]. The lowest mean percentage of germination was recorded at constant 300 C temperature for 24 hours (Barbosa *et al*., 2005) [11]. Seed germination of plant species with bigger seeds does not require light to germinate and such seeds, known as negatively photoblastic, can only germinate under dark conditions or when buried in soil. The results are in accordance with Winter (2004) [12]. 4.1.5 Plant height (cm) and Plant Girth (cm) at 3 months after sowing The data recorded on Plant height at 3 months after sowing in Net house conditions (Temperature 230 to 300 C and RH 70 to 80%) of *Strelitzia reginae* varied significantly and it was presented in Table. 4. Plant height at 3 months after sowing ranged from 6.70 to 8.20 cm. Maximum Plant height (8.20 cm) at 3 months after sowing was recorded in T_4 (250 °C/350 °C for 16/8 hrs.) on par with T_5 (control) and T_1 (200 °C /300 °C -16/8 hrs.). Whereas, minimum plant height 6.70 cm was recorded in T_2 (constant 300 c/24hrs) Data recorded on Plant girth at 3 months after sowing in Net house conditions (Temperature 230 to 300 C and RH 70 to 80%) of *Strelitzia reginae* varied significantly and was presented in Table. 4. Plant girth at 3 months after sowing differed from 2.30 to 2.80 cm. Highest plant girth (2.80 cm) at 3 months after sowing was recorded in T_4 (250 C/350 C for 16/8 hrs.) and followed by 2.65 cm (Constant 300 c/24hrs). However, lowest girth 2.30 cm was observed in T_5 (Control). 4.1.6 Number of leaves/plant (cm) at 3 months after sowing Number of leaves/plant at 3 months after sowing didn't show any significant in Net house (Temperature 230 to 300 C and RH 70 to 80%) conditions and their effects showed in table. 4. Number of leaves/plant at 3 months after sowing ranged from 2.60 to 2.75. Highest number of leaves/plant (2.75) was observed in T_2 (Constant 30 °C/24hrs) and followed by T_4 (25 °C/35 °C for 16/8 hrs.)

and T_5 (2.70). Whereas, minimum number of leaves were observed in T_1 (20 °C /30 °C -16/8 hrs.) (2.60). 4.1.7 Leaf lamina length and Leaf lamina breadth at 3 months after sowing In the present study, Leaf lamina length and breadth was recorded three months after sowing in net house conditions (Temperature 230 to 300 C and RH 70 to 80%) of *Strelitzia reginae.* Data pertaining to this parameter is presented in the Table 5. Leaf lamina length ranged from 4.7 to 5.8 cm. Maximum lamina length at 3 months after sowing was observed in T_1 (20 °C /30 °C -16/8 hrs.) and T_5 (control- Room Temperature) i.e. 5.8 cm, followed by T_4 (5.5 cm) However, minimum Leaf lamina length was recorded as 4.7cm in T_2 (Constant 30^{O}C/24hrs). In respect to Leaf lamina breadth at 3 months after sowing didn't show significant difference between treatments. Maximum leaf lamina breadth at 3 months after sowing was observed as 2.9 cm in T_5 (control) which is followed by 2.8 cm in T_1 (20 °C/30 °C -16/8 hrs.), whereas, minimum leaf lamina breadth (2.5cm) was recorded in T_2 (Constant 300 c/24 hrs.) and T_4 (25 °C /35 °C -16/8 hrs.). 4.1.8 Petiole length and Petiole girth at 3 months after sowing The data presented on Petiole length and Petiole girth is presented in the Table 6. Petiole length at 3 months after sowing ranged from 1.30 to 1.60 cm. Maximum petiole length (1.60 cm) at 3 months after sowing was noticed in T_1 (20 °C /30 °C -16/8 hrs.). However, minimum petiole length (1.30 cm) was noticed in T_4 (25 °C/35 °C for 16/8 hrs.). Petiole girth at 3 months after sowing in net house conditions (Temperature 230 to 300 C and RH 70 to 80%) showed no significant differences between treatments. The data pertaining to this parameter is presented Table. 6. Maximum petiole girth was observed in T_5 (control) i.e. 0.60 cm which is at par with T_1 (20 °C /30 °C -16/8 hrs.). Whereas, minimum (0.40 cm) was recorded in T_4 (25 °C/35 °C for 16/8 hrs.). The vegetative characters of the plant are dependent on seed vigor.

Table 1: Days taken to initiation of germination under different temperatures in *Strelitzia reginae* seeds

Treatment	Days taken to initiation of germination	
	Original mean	Square-root mean
T_1	18.25	4.44
T_2	20.00	4.64
T_3	0.00	1.23
T_4	16.00	4.18
T_5	16.50	4.24
S Em ±	0.01	0.002
CD (*P=0.05*)	0.03	0.007

Treatments
T_1: 20 °C /30 °C -16/8 hrs.
T_2: Constant 30 °C for 24 hrs.
T_3: Constant 35 °C for 24 hrs.
T_4: 25 °C/35 °C for 16/8 hrs.
T_5: Control (Room temperature - 25±2 °C)
No. of replications: 04
No. of seeds/ replication: 25

Table 2: Days taken to 50% and 70% germination under different temperatures in *Strelitzia reginae* seeds

Treatment	Days taken to 50% germination		Days taken to 70% germination	
	Original mean	Square root mean	Original mean	Square root mean
T_1	29.51	5.57	41.31	6.54
T_2	32.50	5.83	45.53	6.86
T_3	0.00	1.23	0.00	1.23
T_4	36.02	6.13	50.41	7.21
T_5	26.51	5.29	37.12	6.21
S Em ±	0.06	0.01	0.07	0.01
CD (*P=0.05*)	0.17	0.02	0.22	0.02

Treatments
T_1: 20 °C /30 °C -16/8 hrs.
T_2: Constant 30 °C for 24 hrs.
T_3: Constant 35 °C for 24 hrs.
T_4: 25 °C/35 °C for 16/8 hrs.
T_5: Control (Room temperature - 25±2 °C)
No. of replications: 04
No. of seeds/ replication: 25

Table 3: Mean percentage germination under different temperature treatments in *Strelitzia reginae* seeds

Treatment	Mean germination percentage	
	Original mean	Arc sin mean
T_1	75.03	60.02
T_2	56.03	48.46
T_3	0.00	0.64
T_4	59.03	50.20
T_5	70.00	56.79
S Em ±	0.02	0.01
CD (*P=0.05*)	0.59	0.04

Treatments
T_1: 20 °C /30 °C -16/8 hrs.
T_2: Constant 30 °C for 24 hrs.
T_3: Constant 35 °C for 24 hrs.
T_4: 25 °C/35 °C for 16/8 hrs.
T_5: Control (Room temperature - 25±2 °C)
No. of replications: 04
No. of seeds/ replication: 25

Table 4: Effect of temperature on vegetative traits (Plant height, Plant girth, Number of leaves/ plant) at 3 months after sowing under net-house conditions in *Strelitzia reginae* seeds

Treatment	Plant height (cm)		Plant girth (cm)		No. of leaves/ plant	
	Original mean	Square root mean	Original mean	Square root mean	Original mean	Square root mean
T_1	8.10	3.11	2.40	1.98	2.60	2.04
T_2	6.70	2.87	2.65	2.04	2.75	2.06
T_3	0.00	1.23	0.00	1.23	0.00	1.23
T_4	8.20	3.13	2.80	2.07	2.70	2.07
T_5	8.20	3.11	2.30	1.95	2.70	2.07
S Em ±	0.02	0.004	0.01	0.003	0.01	0.005
CD (*P=0.05*)	0.06	0.011	0.03	0.010	0.05	0.014

Treatments
T_1: 20 °C /30 °C -16/8 hrs.
T_2: Constant 30 °C for 24 hrs.
T_3: Constant 35 °C for 24 hrs.
T_4: 25 °C/35 °C for 16/8 hrs.
T_5: Control (Room temperature - 25±2 °C)
No. of replications: 04
No. of seeds/ replication: 25
Net-house conditions : Temperature 23 - 28 ºC, RH 70-80%

Table 5: Effect of Temperature on vegetative traits (length of leaf lamina (cm) and breadth of leaf lamina (cm) at 3 months after sowing under net- house conditions in *Strelitzia reginae* seeds

Treatment	Leaf-lamina length (cm)		Leaf-lamina breadth (cm)	
	Original mean	Square root mean	Original mean	Square root mean
T_1	5.8	2.678	2.8	2.080
T_2	4.7	2.490	2.5	2.006
T_3	0	1.225	0	1.225
T_4	5.5	2.650	2.5	2.019
T_5	5.8	2.702	2.9	2.098
S Em ±	0.01	0.011	0.01	0.005
CD (*P=0.05*)	0.03	0.033	0.05	0.014

Treatments
T_1: 20 °C /30 °C -16/8 hrs.
T_2: Constant 30 °C for 24 hrs.
T_3: Constant 35 °C for 24 hrs.
T_4: 25 °C/35 °C for 16/8 hrs.
T_5: Control (Room temperature - 25±2 °C)
No. of replications: 04
No. of seeds/ replication: 25
Net-house conditions : Temperature 23 - 28 ºC, RH 70-80%

Table 6: Effect of temperature on vegetative traits (Petiole length (cm) and Petiole girth (cm) at 3 months after sowing under net-house conditions in *Strelitzia reginae* seeds

Treatment	Petiole length (cm)		Petiole girth (cm)	
	Original mean	Square-root mean	Original mean	Square-root mean
T_1	1.60	1.76	0.59	1.45
T_2	1.40	1.70	0.50	1.41
T_3	0.00	1.23	0.00	1.23
T_4	1.30	1.67	0.40	1.38
T_5	1.40	1.73	0.60	1.45
S Em ±	0.01	0.01	0.001	0.001
CD (*P=0.05*)	0.03	0.03	0.003	0.003

Treatments
T_1:20 °C /30 °C -16/8 hrs
T_2: Constant 30 °C for 24 hrs
T_3: Constant 35 °C for 24 hrs T_4:25 °C/35 °C for 16/8 hrs
T_5: Control (Room temperature - 25±20 °C
No. of replications: 04
No. of seeds/replication: 25
Net-house conditions: Temperature 23 – 28 ºC, RH 70-80%
Temperature maintained: Best temperature (20-30 ºC) observed in Treatment 1 of the first experiment.

Conclusion

The first experiment was carried out with seeds kept in germination paper and exposed to five different temperature regimes *viz*., 20 ºC /30 ºC -16/8 hrs., Constant 30 ºC for 24 hrs., Constant 35 ºC for 24 hrs., 25 ºC /35 ºC for 16/8 hrs. and control (Room temperature 25±2 ºC) in a complete randomized Design with four replications. The study was aimed to find out the days taken for first germination, days taken for fifty percent germination, days taken for seventy percent germination, mean germination percentage.

Seedlings with 3-4 leaves were transferred to shade net where further growth parameters were recorded. The study revealed that, among the different temperatures, least number of days taken for germination and greatest mean germination percentage were found in the temperature 20 ºC /30 ºC -16/8hrs. The least number of days taken for seventy percentage of germination was recorded in temperature 20\ ºC /30 ºC -16/8hrs (41.31). Incidentally, first germination was started within 16 days in 25 ºC -35 ºC for 16/8 hrs. However, lowest days taken for fifty percent of germination (26.51%) and seventy percent of germination (37.19) were recorded in control (Room temperature). Among the temperature treatments studied, 20 ºC /30 ºC-16/8hrs was found to be superior in advancing *Strelitzia reginae* germination. Seedling plant height (cm) was maximum in 25 ºC /35 ºC for 16/8 hrs. whereas Plant girth (cm) and Number of leaves per plant were maximum in 25 ºC /35 C for 16/8 hrs. followed by Constant 30 ºC for 24 hrs. The maximum leaf lamina length (cm), leaf lamina breadth (cm), petiole length (cm) and petiole breadth (cm) were observed in 20 ºC /30 ºC -16/8 hrs.

Based on the results obtained, it can be concluded that, the seeds which are kept under temperature 20 ºC – 30 ºC germinated quickly i.e., 61 days compared to other temperatures. Hence from the experiment, it is concluded that the best temperature for quick seed germination of *strelitzia reginae* is 20 ºC -30 ºC.

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