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# THE JOURNAL OF THE GREENS AND GARDENS

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# Editorial

It is my pleasure to inform the readers of that from this issue the journal has become fully e. Journal. Any one can access the full journal free of cost including members and contributors through the website: www.rgrg.in without any difficulty. This has been done to increase readership and easy access to the journal.

This issue contains wide research topics of varied interest. A review paper on Lotus has been published included in this issue besides a new diseases report on Bougainvillea from China. From next issue, efforts have been made to include more diverse topic of research results. Therefore, the readers will have good opportunity to read diverse topic of interest.

At the global level the focus of floricultural research is on end products and technologies to fulfill the future demands of the new generation having fascination for new and novelties.

As per the objectives of RGGF, we have been organizing training programmes of various topics for capacity building, development of entrepreneurship and general gardening. We have planned a workshop on Ornamental Horticulture specially for the students and research scholars in November, 2022. We invite all students and faculties for large scale participation to make the event successful and derive maximum benefits out of the Workshop.

I congratulate the contributors for their submissions and taking interest to the journal. Editorial board did a good job for screening of the papers and publication. I am grateful to every body who are directly and indirectly associated with the Foundation and the Journal. All The best.

Place: Lucknow
Date: July 17, 2022

**Dr. R.K. Roy**
**Chief Editor**

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**Review Paper**

# Lotus (N*elumbo nucifera*): A versatile plant species for the mankind

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**ABSTRACT**

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**Key words:** .....

## Introduction

Lotus comprises an integral part for the conservation of the aquatic ecosystem and has deep roots in all the religions world over as well as the Hindu mythology. *Nelumbo* is among the oldest flowering plants on this planet (Wang *et. al*., 2022). Lotus flower has been the most perfect, elegant and beautifu

l. Since time immemorial, it has been the symbol of purity, beauty, divinity and eternity. It is an important constituent of the aquatic ecosystem (Mohan Ram, 1991). A pond full of lotus plants in bloom exhibits a captivating effect on all of us. Lotus possesses extraordinary aesthetic, medicinal, nutraceutical, ayurvedic and economic values. It is not only important in India but is highly revered in whole of South East-Asian region (Babu & Gopinathan, 1986). The Lotus flower is said to be the centre of the universe in Hindu religion. Lotus flower represents India and the leaves depict the surrounding various cultures and countries. There is a legend that the lotus plant arose from the navel of the Great God 'Vishnu' and at the centre of flower sat 'Brahma'. The role of 'Brahma' was to recreate the universe after the great flood ( Mitra & Kapoor, 1976).

The lotus is grown and conserved in ponds and aquatic bodies and the flowers are treated with great reverence. *Nelumbo* is found from Kashmir to Kanyakumari showing enormous phenotypic plasticity and diversity with a large number of racial/ecological variants in different shapes, sizes and shades. Every year on Republic Day, the Government of India awards to some of the distinguished personalities in various fields, the honours like 'Padmashri', 'Padmabhushan' and 'Padmavibhushan'. Similarly, the Golden Lotus trophy is awarded every year to the best feature film produced in India. Due to its multifarious significance, it has always found significant place on the coins and postal stamps of many countries all over the world including India.

## Distribution

The genus *Nelumbo* Adans. is widely distributed throughout tropical and subtropical regions of the world. It is found in lakes, ponds, streams and estuaries of tropical and subtropical zones. *Nelumbo nucifera* Gaertn. distributed over a wide range of phytogeographical regions, exhibits great diversity in different shapes, sizes and shades of red, pink and white flowers **(Figs. 1-2).** This species generally known as 'East Indian Lotus' is an old world Asiatic taxon widely distributed to many Asiatic countries, including India, Sri Lanka Myanmar, Indonesia, Malaysia, Thailand, Korea, Vietnam, Japan, China and Taiwan (Khoshoo,1980).

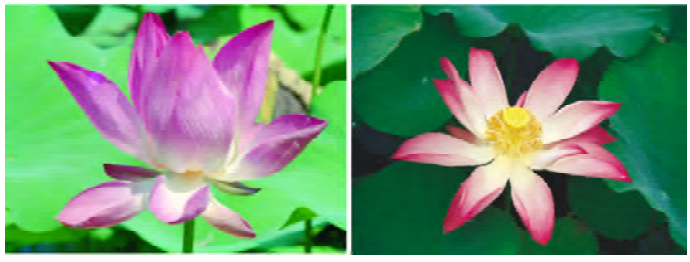

Fig. 1: *Nelumbo nucifera* (pink cultivars)

Fig. 2: *Nelumbo nucifera* (pink &white double flowers)

It is also naturalized in Northern Australia, Hawaii and to the Volga river delta area where the river flows into Caspian Sea (near Southern Russia) (Borsch & Barthlott, 1994).*N. nucifera* is an old world Asiatic species, now widely distributed to many Asiatic oriental countries, including India, Thailand, Japan, China and Taiwan. Originally, lotus was considered as the native to the ancient Egypt in the lakes and back waters of the Nile river as a 'Sacred Bean' but now it no longer grows there. It possesses many racial variants and ecotypes which have crossed naturally due to its wide phytogeographical distribution, adaptations to varied climatic regimes and also by man over the centuries (Jain, 1990).

6-7 decades ago in India, ***N. nucifera*** was widely distributed in the ponds and lakes in almost all the geographical regions of the country ranging from northern to southern states. During the intensive survey it has been revealed that the population of lotus has dwindled considerably in our country. Lotus is spectacularly seen in ponds on both the sides of highway from Thiruvananthapuram to Kanyakumari in various shades of pink and white. In Manipur Lotus grows widely in the wetlands. But in recent years the population of this species in the wild habitat is declining due to shrinkage of wetlands and land use change of water bodies. Small population of lotus is also cultivated in ponds of many households in the valley of Manipur. Lotus is sacred to the people and believed that it considerably lowers the level of water pollution. Fresh water Sanapat Lake is located in the Bishnupur district of Manipur state in north-eastern India. This lake covers an area of 55 hectares is a natural Lotus growing area (Goel, 2001).

**Ecology and Habitat of Lotus**

Lotus is a wetland macrophyte. It occurs widely in subtropical, tropical, sub-temperate and temperate regions throughout the country in fresh water aquatic bodies. Throughout the Indian sub-continent, there are many shallow water bodies with an average depth of less than two meters inhabiting this species. Growth of the floating leaved plants is governed by the ability of their petioles to elongate as per the water depths. *Nelumbo* is well known for the elongation of its petioles by intercalary meristematic growth following a rise in the levels of water. The aquatic weeds, like *Eichornia crassipes* 'Water hyacinth' checks drastically the growth of this species. Especially the white flowered *Nelumbo* is getting eradicated rapidly by the invasion of such new world weeds. In Odisha region multi-petalled white Lotus is quite common where as in West Bengal multi-petalled pink and white *Nelumbo* have been located mainly from Midnapur region.

It is interesting to note that this species is able to grow in a wide range of -pH (7.5–9.0) but during its growth brings the -pH to neutral. Eutrophication by agricultural runoff and domestic sewage is commonly held responsible for the explosive growth of this species. During the course of exploration, *N. nucifera* with pink flowers was recorded from a saline lake (-pH 9.3) near Samaspur in Raebarielly district of Uttar Pradesh depicting the variable range of habitats adopted by this species. Besides it has been vigorously growing in the Nawabganj lake in Unnao district. These both the sites are declared as the Ramsar sites in UP.

It has also been observed during investigations that it possesses the ability to uptake heavy metals and can be cultivated in the ponds receiving industrial effluents and thus serves the purpose of water purification in the aquatic bodies receiving industrial waste water. During the course of studies on *N. nucifera*at CSIR-NBRI Botanic Garden, The germplasm material was collected from various locations in India including Uttar Pradesh as well as on exchange from Botanic Gardens from within and outside the country. The germplasm collection was acclimatised and conserved for various R&D studies in a 10-chambered aquatic body**(Fig.3)** in NBRI Botanic Garden (Goel 1999a, 1999b, 2001) .

Fig. 3: View of lotus cultivars blooming in aquatic body at CSIR-NBRI

*Nelumbo* is a long-day plant and prefers full sun light, moderate humidity and temperature during the growth season. July is the best time for the flowering in lotus. Deep water is not suitable for the optimum growth of lotus plants. The plant can usually tolerate water up to 1.5 m in depth. The seeds disposed in the area can protect themselves from the impact of adverse conditions and once the conditions are favourable, seeds start germinating to keep the continuity and survival of this species. The dispersal of lotus seeds is carried out in water by the floods. Lotus prefers calm and shallow water like pond and lake. Optimum depth of the water level is 1.0 m for best performance and yield. When leaves dry up and dormancy starts, lotus needs little water but not completely dry soil.Light clay with rich organic matter is ideal for lotus cultivation. Soil with 6.5-7.5 pH favours lotus cultivation. For the production of lotus flowers, ideal temperature is 30-35$^0$C. Lotus and fish live comfortably and maintain good ecological balance in ponds (Goel *et. al.*, 2001).

**Taxonomy of Lotus (*Nelumbo nucifera* Gaertn.: Nelumbonaceae)**

Aquatic perennial; leaves suborbicular, 20 - 80 (-100) cm across, flat while floating and cupped when emerged, glabrous and glaucous on both the surfaces; petioles 1 - 2 m long fistulous beset with hard minute papillae like structures; flowers 8 - 25 (-30.0) cm across, rose-pink to white, fragrant; sepals 1.5 - 5.5 x 0.8 - 3.5 cm, ovate to elliptic, concave, green (in white flowers) or pinkish-green (in rose-pink flowers). Petals 16 - 24 (in single forms) or 116 - 160 (-198) in double forms; stamens up to 230, 2.2 - 5.0 cm long; outermost staminodial in double forms; receptacle 5.0 - 10.0 cm across, spongy, yellow during anthesis; stigma papillose. Fruit oblong to ovoid, glabrous, pericarp thick, hardened, 1.0 - 2.0 cm in length and 1.0 - 1.5 cm in diam. (Lawrence, 1963) **Flowering & Fruiting March – October.**

**Lotus Seed Longevity**

*Nelumbo* is considered among the one of the oldest flowering plants on the planet. This species is known from the geological records as early as 135 million years dating from the time when dinosaurs roamed the earth in the Jurassic age. Jane Shen-Miller a plant physiologist at University of California, Los Angeles (USA), obtained seven brown oval lotus seeds from Beijing Institute of Botany, P.R. China (Ohga, 1926). In 1995 it was reported that scientists germinated a lotus seed which was about 1,288 years old (Shen-Miller *et. al.*, 1995). The impervious seed coat and the presence of hardy proteins in embryo and cotyledons may explain partially the remarkable longevity of the ancient and sacred lotus. The lotus seed is so robust that it can sprout after centuries of exposure to low-dose gamma radiation. The repair mechanism in the lotus would be very useful if they could be transferred to the other crops, such as rice, corn and wheat whose seed life span is only for a period of few years (Hong *et. al.*, 1998).

**Thermoregulation in Lotus Flower**

Lotus flower works like a thermostat. *N. nucifera* not only produces a significant amount of heat during the sequence of flowering but also regulates temperature quite precisely. If the air temperature varies between 10$^0$ and30$^0$C, flowers remain at 30$^0$ - 35$^0$C throughout their life span of 2 - 4 days. *Nelumbo* flowers are protogynous and have variable sequence of anthesis that favours out crossing through the insect pollinators. A conical receptacle that contains several carpels forms the bottom of an otherwise empty floral chamber before the petals open. Stamens grow around the receptacle and are initially pressed close to it by the petals, but are released when the petals open fully. Starch present in the staminal appendages of *Nelumbo* is thought to be major site of heat production. Common explanation for the heat production in flowers is that it enhances evaporation of flower scent which attracts insects and protects flowers from the cold. This is an incentive for the pollinators particularly endothermic flying insects. Beetles that are trapped overnight fed and copulated with in the floral chamber and get released unharmed in the next morning to carry the pollen to other flowers for pollination (Seymour & Motel, 1996).

The environment in the floral chamber would maintain a high body temperature for the insect and promote not only feeding, digestion and reproductive behaviour, but also suitable body temperature for flight. Many insects including beetles and bees require thoracic temperatures of above 30$^0$C to initiate flight and the lotus flower could be directly preparing them for departure, thus eliminating their requirement for endogenous heat production. Alternatively, the flower itself may require a constant temperature for proper development of its own reproductive structures or to protect sensitive parts from damage that might occur if heat production were uncontrolled. The pollens stick to escaping insects, which fly off to repeat the cycle. This sequence prevents self-pollination and promotes cross-pollination which favours high reproductive success thereby increasing the genetic diversity and strong off springs in lotus.

**Propagation & Cultivation**

Lotus is sexually propagated through seeds and asexually by planting the rhizomes. For the practical purposes storage of seeds for 8 years has no effect on germination rate. Average weight of the lotus seed is 1.0 gm.

Thus 10 kg seeds are required for the lotus cultivation in one hectare of pond area.Hard coat of the seed should be scarified at both the ends on a sand paper. All care should be taken not to damage the flesh of the seed while filing. Seeds are soaked in warm water (25 - 30$^0$C) with 12 hours light to encourage germination. Water should be changed daily until the seeds germinate which takes generally 5 - 8 days. Transplanting should be done after 3 - 4 weeks when seedlings have 2 - 3 leaves and few roots. Seedlings should be planted separately in individual pots and placed in water. The depth of the water should be increased gradually as the plant grows. Late in spring rolled-up leaves push out of the mud. The crinkled leaf slowly opens during the warm days and soon becomes a big platter with a depression in the centre where the petiole joins from below. However 50% Chromic acid and concentrated Potassium hydrate also help in overcoming the impermeability after a longer period of time. But scarification of seeds was found to be the easiest and safest method for raising the seedlings of lotus (Slocum, 1985; Slocum & Robinson, 1996). The resulting off springs will differ from both the parents. Further, germinated seedlings will not produce a crop until the following season**(Fig.4)**.

Fig.4: Fresh green torus and dried matured seeds of Lotus

**Vegetative Propagation**

Healthy rhizomes are selected for raising lotus crop. To ensure the blooms in first season, rhizomes should be planted with at least two growing points. The growth points must be protected, if they are broken during plantation, entire rhizome will die. They are shallowly planted in clay soil with rich organic matter. Rhizomes are planted at a 30$^0$ angle in the mud. Distal end should be placed 10 cm inside the mud and proximal end protruding from the water. The crown of the rhizome should not be covered with soil. Initially the depth of water should be only 6 cm which should be raised gradually up to 30 cm as the crop grows. The ideal water temperature for rhizome plantation is 25-27$^0$C. The growing tip should be pointing towards the centre of the pond or pot, as this will develop into a runner. This will branch off and spread throughout the mud, producing aerial leaves and flowers as the season progresses. The rhizome grows at a surprising rate about 10 meters in a year. At each node as point of growth, plant produces first a leaf scale on the lower side then other one on the upper side followed immediately by a foliage leaf. From the axil of the upper leaf scale flower emerges which gives the plant great potential for flowering and spreading.Lotus plants are seldom affected by aphids, beetles, snails and shrimps. They can be easily managed and picked up by hand or dislodged by spraying a jet of water. They are also attacked by dry spot disease and brown strip disease. Suitable fungicides are used to control them. Aquatic weeds are sometimes a major problem in lotus cultivation particularly during the summer months as the growth of weeds is faster. Commonly found weeds in lotus pond are: water-hyacinth (*Eichhornia crassipes*) which spreads fast and cover the entire water surface. Species of *Typha,Lemna,Wolfia,* are other common weeds found in the lotus ponds (Swarup, 1989).

**Lotus Cultivars**

Size, shape, number and colour vary from cultivar to cultivar in lotus. Large flowered lotus cultivars are up to 30 cm dia and the small-flowered cultivars are less than 10 cm dia. Number of petals range from 8 to 1000. Petals are white, pink, rosy red, red, light yellow and bi-coloured. The shape of the petal varies from elliptic to long elliptic and are arranged spirally at the base of the receptacle. The single lotus flower transforms into double forms from stamens to stamenoids and finally to the petals. Lotus cultivars have been classified into three categories according to their usage e.g. rhizome, flowers and seeds. Some cultivars may exhibit one or more of the three characters but generally each is classified by its salient feature. There are nearly 400 *Nelumbo* cultivars world over. Lotus flowers are termed single when they have less than 25 petals, semi-double if they have 25 to 50 petals and the double if they have more. Lotus cultivars have also been classified as per their height, small, medium and large. The other way to classify cultivars is as per their colour e.g. red, pink, white, pale yellow and their various shades (Perry, 1989). A very unique and charming 160 petalled pink coloured lotus race from Midnapore, West Bengal was discovered and introduced in the Botanic Garden of CSIR-National Botanical Research Institute, Lucknow in 1996. This race has been named as *Nelumbo nucifera* 'Krishna' (Kamal Krishna) (Goel *et. al.,* 2003) **(Fig.5).**

**Economic & Medicinal Importance**

Almost all parts of lotus are edible and eaten in Asia and Australia. Tasty soup is prepared from the rhizomes.Another type of soupis prepared with the lotus seeds and the red beans. It is served at banquets for newlyweds for blessings for having a child next year. The soup is also presented at the New Years's festival in

Fig. 5: *Nelumbo nucifera* 'Krishna' Pink Double Lotus' in a aquatic body at NBR

China.Lotus rhizomes are a powerhouse of nutrients extremely rich in vitamins and minerals viz.: Vitamin-B6 and Vitamin-C, Thiamin, Pantothenic acid, Zinc, Potassium, Phosphorus, Copper, Iron and Manganese. Rhizomes are low in calories and it is believed that adding lotus rhizomes in one's diet can significantly reduce the bad cholesterol levels and reduce the risk of cardiovascular diseases. Presence of healthy dietary fibres can help in improving digestion and relieving ailments like constipation and in losing weight (Mukherjee *et. al.,* 2009). Old Indian and Chinese references are indicative of powerful medicinal properties of lotus against a number of human ailments involving the digestive, hepatoprotective, reproductive, circulatory and excretory systems. Almost, all the parts have tonic and astringent properties and are recommended for the treatment of spermatorrhoea, gonorrhoea, insomnia, metrorrhagia, dyspepsia etc. (Huang *et. al*., 2010; Tripathi *et. al*., 2019).

Flowers are used as astringent in diarrhoea, cholera, fever and diseases of liver. They are also recommended as cardio tonic. Flowers are decocted for abdominal cramps, blood discharges, metrorrhagia and non-expulsion of the amniotic sac (Chopra *et. al*., 1958). In Sri Lanka and Southern India, the flowers are considered diuretic and cooling. Lotus flowers are boiled in milk with equal amount of flowers of *Eugenia jambolana* made into a paste and then balls to the size of an Areca nut. They are given to women for the relief of false pains in early months of pregnancy. The dried pink red petals are used by the Chinese as cosmetic application to the face for improving complexion. The tender leaves, petioles and flowers are also eaten as vegetables. All parts of the lotus flowers and leaves of lotus are a traditional inebriating smoke, similar to mild cannabis. They are brewed into a delightful tea. Considering the immense medicinal peoperties of *Nelumbo,* it was regarded as '*Soma*' of the ancient times (Mc Donald, 2004). Lotus leaves also possess the property of reducing the fat (Ye, *et. al.,* 2021).

The Lotus flowers are used for the extraction of highly valued perfume, the costliest among the plants world over. As a flower essence, lotus has varied usage. It is called the spiritual elixir helps in meditation by calming the mind and improving concentration. Lotus is an excellent elixir for balancing, cleansing and strengthening the aura. All the chakras are aligned and balanced by releasing, adding, or directing energies to them, thus releasing better health and harmony (Rahman *et. al.*, 1962). Lotus essence can be used in the bath therapy

**Lotus Silk**

Lotus silk is considered as one of the rarest and the most luxurious and beautiful fabrics in the world, produced only in small scale by the indigenous people all across Cambodia, Myanmar, and more recently in Vietnam. This natural fibre is only extracted by some ethnic skilled craftsmen in these countries. Extracting enough lotus silk even for one scarf can take up to two months, and the final product can cost 10 times more as much as the regular silk. Lotus silk is obtained from the matured leaf petioles and the floral pedicels which are handpicked regularly by these locals from ponds and lakes. Lotus silk yarn is fragile, but once woven, can be as durable as the traditional silk or more shiny,elastic and durable than the silk. A 25 cms. scarf can cost as much as 200 US$. A team of nearly 20 workers can create lotus fibres each day, allowing them to produce 10 to 20 scarves every month. This soft silk is breathable like linen, and slightly more elastic, cool and highly durable. Such luxurious traits have made it popular with tourists searching for the rare souvenirs and new luxury fibre (Dokania, 2021). India may become the hotspot of the lotus silk. It will improve the economic conditions of the masses in rural areas specially to the womenfolk.

**Biological Implications of the 'Lotus-Effect'**

The lotus cuticle is the outer most barrier of plants towards their environment and is, therefore, the first protective layer. It was shown that in polluted areas where plants are heavily contaminated with dust, leaf surface temperature increased under isolation. Particles within certain size range occlude stomata and influence stomatal diffusive resistance. Water repellent plants escape from those harmful effects through the Lotus-Effect. Lotus-Effect plays another important role in the defence against pathogens. Therefore, the epicuticular wax crystalloids and their physical properties may be regarded as the first line of

defence against the pathogens. The self-cleaning mechanism may be the most important function of many micro-structured biological surfaces (Jeffrey, 1986). This effect can be transferred to the artificial surfaces (e.g. cars, facades, foils) and innumerable technical applications. Now a days, water-repellence has gained keen interest because it represents the basis for a self-cleansing property of such surfaces called the **"Lotus Effect"**(Barthlott & Neihuis, 1997; 2001)**.** The German scientists have developed a unique paint **"Lotusan"** which mimics lotus leaf and repels dust particles and water droplets keeping the building clean.

The special feature of lotus leaves allows water and dirt particles to run off from the leaf surface. The Lotus Effect is due to characteristic molecular structures present on the surface of the lotus leaf which ensures that water drops and dirt remain on the tips of the plant structures, minimizing the leaf contact area with foreign objects. This property is being applied for developing self-cleaning textiles. A project has been undertaken in co-operation with NEES-Institute for Biodiversity of plants at the University of Bonn and BASF. Such textiles would need only water for cleaning, thus saving money and time on washing. Textiles utilizing Lotus Effect would also be more resistant to the wear and tear.

**Conservation and Bioremediation of Aquatic Bodies**

The aquatic bodies and wetlands comprise the most important components of the natural ecosystems. During the last six decades, aquatic habitats are deteriorating rapidly due to extensive demographic pressure, urbanization, invasion of aquatic weeds and increased inflow of industrial effluents causing environmental degradation and serious threat to the natural ecosystems and aquatic habitats. *Nelumbo* falls under the fourth category and its over exploitation for various purposes is a common practice all over the country (Sharma *et. al*. 1998; Sharma & Goel, 2000, 2001). This has resulted in the depletion of Lotus population considerably. In Chhattisgarh rich natives prepare small ponds for planting the lotus. In home gardens lotus is the essential component to bring happiness and prosperity.

Lotus has the ability to uptake heavy metals and can be grown in the ponds receiving the industrial effluents and serves the purpose of water purification in the aquatic bodies. Lotus has high tolerance for the sulphur dioxide and can be planted in the ponds around industrial regions (Kanabkaew & Puetpaiboon, 2004). Chromium is one of the most toxic metals widely found in the water bodies. Large scale use of chromium in metallurgical, pigment and dye, textiles and electroplating make these industries potential source of chromium pollution. Chromium is highly toxic to aquatic plants which results in the reduced roots, phytomass and photosynthetic pigments, chlorosis, stunting and plant death eventually (Vajpayee*et. al*., 1999). Lotus plants have shown greater potential in ameliorating the metal load of waste water by active uptake and surface adsorption.

**Lotus: The Future Crop**

Considering the ornamental, medicinal and economic importance, lotus is the crop of the future (Zhongyuan *et.al*., 2019). Low lying areas in the fields should be utilized for the cultivation and conservation of Lotus. To popularise the lotus crop, Horticulture Departments and Agricultural Universities should take up the research and developmental programmes. There should be model layouts giving the details of the crop cultivation as well as techno-economics. The progressive farmers should be invited to participate in the seminars. Field trips should be arranged for the entrepreneurs. They should be provided literature on the crop. Post-harvest technology for the cut lotus flowers and rhizomes are very important factors. Lotus is deeply associated with our culture. There is a heavy demand for the lotus flowers in the temples and marriage ceremonies. The dry seed pods fetch good price as the excellent dehydrated items in the floral decoration. By the sale of the rhizomes, flowers and seeds one can earn a net profit of over Rs.75,000/- to 1.00 Lakh per hectare. Fish culture along with the Lotus cultivation can be quite lucrative business. Apart from the domestic market there is good scope for the export of rhizomes in South East Asian countries. *Nelumbo* is one of the best plant species for the conservation of the water resources in the ponds and lakes.

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**Research Paper**

# First Report of Leaf Spot Disease on *Bougainvillea* sp. Caused by *Robbsia andropogonis*in from Hainan, China

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**ABSTRACT**

Bougainvillea is popular as ornamental plant in southern China. Since 2016, blight spots were observed on leaves of *Bougainvillea sp*. plants growing in Hainan. To identify the causal agent, bacterial isolation, pathogenicity tests, physiological analysis, 16S rRNA sequencing, and phylogenetic analysis were done. The bacterial pathogen was identified as *Robbsia andropogonis*. This is the first report of bacterial blight on Bougainvillea caused by *R. andropogonis* in China mainland. Although there is no clear epidemiological information on the inoculum source, the recent occurrence of the disease indicates that it is a potential threat to the Bougainvillea industry and control management should be taken to avoid spreading and consequent damage.

**Key words:** Bougainvillea, Leaf Spots Disease, *Robbsia andropogonis*, Molecular identification

## Introduction

*Bougainvillea belongs to the family Nyctaginaceae and it* is a native of tropical region of South America. Bougainvillea have a short history (about150 years) of domestication and cultivation outside their natural habitats (Zadoo *et al*. 1976; Roy &Singh, 2016). Due to its ornamental and other horticultural advantages and recurring blooming habits, bright and colorful bracts, strong stresses tolerance, easy propagation and maintenance, etc., B*ougainvillea has been one of the most popular ornamental plant in* landscaping and potted *plants in tropical and sub-tropical areas.*

In southern China, bougainvillea is one of the most common landscape plants. It is the official provincial flower of Hainan Province and the 'City flower' of Shenzhen, Sanya, Xiamen, Zhuhai, Huizhou, Heyuan, Wuzhou, Beihai, etc. During the last decade, the bougainvillea industry has expanded rapidly in China. According to the latest statistics data (Weng *et al*., 2022), the production area is nearly 10, 000 hectares and the annual output value reached US $1.3 billion.

Although bougainvillea is generally considered as an ornamental plant with strong biological stress resistance, it still faces the challenges from diseases and pests in large-scale production and application. Bacterial Leaf spot caused by *Robbsia andropogonis* (syn. *Burkholderia andropogonis*, *Pseudomonas andropogonis*) is one of the destructive diseases and its outbreak reduces the ornamental and commercial value of bougainvillea products (Rothwell *et al*., 1964; Walker & Hodge, 1991; Sivapalan & Haji, 1997; Li & De Boer, 2005; Ponaya & Cumagun, 2008; Morales-Galván *et al*., 2022). Although *R. andropogonis* is not considered a quarantine organism in many countries, this pathogen has been reported in many areas around the world and infected a wide range of crops (Vidaver & Carlson, 1978; Yoshiyuki et al., 2004; Young et al., 2007; Tomomitsu *et al*., 2016). Itsincursions or outbreaks had caused serious devastating for agriculture production. *R. andropogonis* could be quickly spread by wind, pest, irrigation, tools as well as clothing. It commonly triggers necrotic spots under high temperature and humidity condition. This pathogen can survive in in shoots and leaves without producing symptoms, or in soil, plant residues for several months, and function as inoculum sources for repetitive infections. Once introduced into a new growing area and breakout, blight disease would hardly be eliminated completely, even following a strict sanitation management. So, the early detection of *R. andropogonis* to develop and grow pathogen-free plants is the most effective measure to prevent blight disease.

## Material and Methods

### Disease Investigation

Since 2016, leaf spots similar to those caused by *R. andropogonis*were observed on leaves of *Bougainvillea sp.* plants growing in a nursery in Danzhou, Hainan Province (N 19° 292 25.083 , E 109°292 33.983 ).The disease course, symptoms and incidence were observed and recorded.

### Pathogen Isolation and Pathological Test

The infected leaves of bougainvillea 'California Gold', 'Rosa', 'Crimson Lake' and 'Pixie Queen', were sampled and disinfected the surface with 70% ethanol for 30s, then rinsed with sterile water for 4 times. The margin of foliar lesions were cliped out and added into a 1.5- ml microtube containing 0.5 ml of sterile distilled water, soaked for 10 min, and vortexed vigorously to make a suspension. At last, a 1/10 serial dilution was spread on 1/10 NA medieum. Pathogenicity tests were performed on 1-year-old plants of bougainvillea'California Gold' by infiltration with $10^8$ CFU $ml^{-1}$ suspension. Control plants received sterile 10 mM Tris solution. Plants were kept in a greenhouse at approximately 28°C (±3°C) with 90% (±5%) relative humidity.

### Molecular Identification

For DNA extraction, bacteria cells were cultivated in liquid medium (1 liter containing 7 g yeast extract, 7 g peptone, and 7 g glucose; pH7.2) for 24 h at 28 °C with 200 rpm agitation, genomic DNA was extracted using TIANamp Bacteria DNA Kit (DP302, TIANGEN Biotech (Beijing) CO., LTD) and stored at -80 °C for a long-term storage. To confirm the identity of the bacteria, the 16S rRNA genes were amplified with specific primer pairs 27F/ 1492R (27F: 52 - AGAGTTTGATCMTGGCTCAG-32; 1492R : 52 - GGYTACCTTGTTACGACTT-32) and Pf/Pr (Pf: 52 AAGTCGAACGGTAACAGGGA-32, Pr: 52 - AAAGGATATTAGCCCTCGCC-32), respectively (Lane1991; Bagsic et al. 1995).

For conventional PCR amplification, the program included a pre-denaturation step at 95 °C for 3 min, 30 cycles consisting of denaturation at 94 °C for 30 s, annealing(54 °C for 27F/1492R, 48 °C for Pf/Pr) for 30 s, 72 °C for 1.5 min, and an extra extension step at 72 °C for 10 min. 5 ìl of PCR products were subjected to electrophoresis, stained with ethidium bromide and visualized under UV light.PCR products obtained from the various samples were purified and sequenced on the Illumina MiSeq platform. Raw 16S rRNA paired-end sequences were processed and deposited in GenBank. BLASTn search was performed against NCBI genebank database(http://www.ncbi.nlm.nih.gov/blast/).. The sequences of related bacterial strains were downloaded and the phylogenetic tree was calculated using the neighbour-joining method and bootstrap analysis with MEGA7 software (Kumar et al. 2016).

## Results and Discussion

### Symptoms and Disease Development

The disease incidence was approximately 30% of 60, 000 plants. On younger foliage, the leaf spots are small reddish-brown at early stage, then enlarge into circular or irregular dark necrotic spots. Lesions have a tan center surrounded by a dark red brown margin, and are sometimes bordered by a chlorotic halo (Figure-1). Under conditions of high relative humidity, the lesions develop quickly and are often black and vein delimited. Infection of developing leaves and bracts results in puckered, distorted growth, even defoliation when leaf spotting, blighting or marginal necrosis becomes severe.

### Pathogen Isolation and Pathological Test

From the margin of foliar lesions on bougainvillea 'California Gold', 'Rosa', 'Crimson Lake' and 'Pixie Queen', four greyish-white bacterial colonies were isolated on NA media. All isolates contained gram-negative rods, and were positive for catalase, phosphatase and urease, and negative for fluorescent pigments, oxidase, arginine dihydrolase, gelatin hydrolysis, starch hydrolysis and nitrate reduction. For pathogenicity tests, 40 to 50 days after inoculationon bougainvillea 'California Gold', leaf spots developed that were similar to those observed in the nursery, while no lesion developed on control plants. Koch's postulates were fulfilled by reisolating bacteria from leaf spots on inoculated plants. Based on colony morphology, biochemical and pathogenicity tests, isolates from bougainvillea were confirmed as the causal agent and identified as *Burkholderia* sp (Li and De Boer, 2005; Tang et al. 2013).

Figure - 1. Disease Symptoms of *R. andropogonis* on bougainvillea in Hainan, China
[Early (left), Moderate (middle) and Severe (right)].

## Molecular Identification

PCR amplification produced the expected 410-bp amplicons with genomic DNA templates from the four isolates. Sequences from RaCG1, RaCL1, RaPQ1 and RaR1 isolate were deposited at the NCBI database (Gen Bank Accession Nos. MG928419, MG928420, MG928421 and MG928422).Sequences of the four isolates shared 99% sequence identity with each other, and 98.65~99.19% sequence identity with the 16S rDNA of *B. andropogonis* (MK063729.1,LC507981.1 and LC376007.1). A phylogenetic tree was constructed using partial 16S rDNA sequencesagainst the database of Gene bank. These results confirmed that all four isolates was in the same cluster as *R. andropogonis* (Figure - 2).

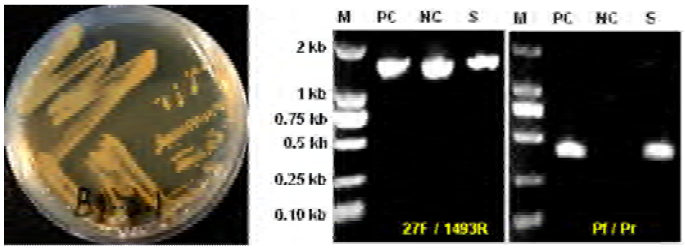


**Figure - 2**. The bacterial isolates grown on NA plate (left) and the PCR products for molecular identification (right). M: 2kb molecular marker; PC: positive control; NC: negative control; S: the tested sample.

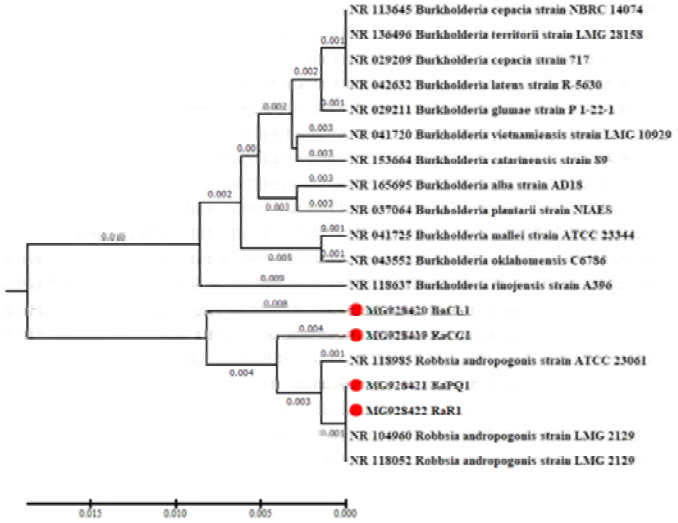


**Figure - 3.** Phylo-genetic tree produced from the partial sequences of 16s rRNA gene. The sequences with red ball from the isolates obtained from this study, and others from Gen Bank accession numbers. Bootstrap values are shown as percentages of 1000 replicates.

## Conclusion

Recently, the species *B. andropogonis* was reclassified as *R. andropogonis* based on phylogenetic and genomic comparisons (Lopes-Santos *et al.* 2017).To our knowledge, this is the first report of *R. andropogonis* infection on bougainvillea in Hainan Province, mainland China. Hainan has tropical coastal weather with high humidity and high temperature, which is optimal for *R. andropogonis* infection. So far, no eco-friendly and effective bactericide or biological production is available for disease management. To reduce the risk of disease outbreak, control measures, such as plant destruction should be taken, and potentially infected nursery stock should be quarantined to avoid spreading.

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**Research Paper**

# Response of various holding solutions on physical appearance and vase life of carnation (*Dianthus caryophyllus* L.) cut flower

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**ABSTRACT**

India has a long tradition of floriculture and references to flowers and gardens are found in ancient Sanskrit classics. *In India, carnation (Dianthus caryophyllus L.) is* one of the popular cut-flowers. Moreover, Carnation is a leading cut-flower crop in the world floriculture trade and ranks within top ten cut flowers of the world. I*t belongs to fami*ly Caryophyllaceae. Carnation usually loss their freshness and quality after the cutting from the plants it may be due to wide difference in temperature, light intensity and humidity which not only affect the yield and quality of the flowers but also limit their availability for a particular period of a year. To produce quality flowers, carnation need to be grown under protected structure and also needs carnation flowers after harvesting placed in different holding and pulsing solution for maintaining and preserves the best quality of carnation flowers. Thus, the keeping in view aboves, a case study was conducted to evaluate the response of various holding solutions on physical appearance and vase life of carnation (*Dianthus caryophyllus* L.) cut flower in Horticulture Laboratory of School of Agricultural Sciences and Technology, RIMT University, Mandi Gobindgarh, Punjab, India. The study consisting two concentration of sucrose (1.0 and .02%), $GA_3$ (3 and 6 mg/lit.) and ($Al_2(SO_4)_3$ (100 and 200 mg/lit.). Study reveled that $GA_3$ 6 mg/liter of water and $Al_2(SO_4)_3$ 100 mg/liter of water produced good physical appearance and vase life of carnation cut flower up to 18 days after harvesting.

**Keywords**: Aluminium sulfate, Carnation, Gibberellic acid, Sanskrit and Vase life.

## Introduction:

The social and economic aspects of flowers are always well recognized. Dedication and exchange of flowers at all social events, places of worship and their use of women's hair and home decor have become an integral part of one's life. With changing lifestyles and growing urban affluence, floriculture has gained a stable commercial status in recent times and especially during the last two decades. Awareness of the power of commercial floriculture has made the sector flourish as a viable agricultural business option. The availability of natural resources such as various agricultural conditions allows for the production of many cool and tropical flowers, almost year-round in one part of the country or elsewhere. Improved communication centers have expanded their availability to all parts of the country. The commercial activity of producing and selling floriculture products is also a source of profitable and quality employment for many people.

Floriculture products mainly consist of cut flowers, pot plants, cut foliage, seed pods, root crops, root cuttings and dried flowers or leaves. Important flowering plants in the international cut flower business are rose, carnation, chrysanthemum, gladiolus, gypsophila, orchids, anthurium, tulip and lilies. Floriculture plants such as gerbera, carnation, etc. they are planted in green houses. The plants of the open field are chrysanthemum, roses, gaillardia, lily marigold, aster and tuberose etc.

Carnation *(Dianthus caryophyllus L.)is* a member of the family Caryophyllaceae is one of the leading cut flower crops in the world florist trade and ranks within top ten cut flower of the world. It is half hardy perennial with branching stems and timid joints, leaves are linear, glaucous, in opposite or decussate pairs. Each stem forms terminal flowers which is bisexual or occasionally unisexual. The hybrids have remarkable long flowering period which produces blooms continuously in mild weather.

Cut flowers are one of the huge income generators of fresh commodities in Global market (Da Silva, 2003).The vase life of cut flowers is one of the most important characteristics that determine their ornamental value and their ability to satisfy consumer preference (Kazemi and Ameri, 2012a).The decline of the ornamental value of cut flowers after harvest may depend on many reasons such as sharp rise in temperature and humidity and rise in respiration (Kazemi *et al.,* 2011). The senescence of climatic flowers, such as carnations, is associated with a climatic rise of respiration, loss of membrane fluidity, and reduction of endogenous sugar (Zuliana *et al*., 2008). Hence, cut Carnation flower reduce its quality and market value petal enrolling, petal discoloration and leaf wilting and discoloration (Song *et al.,* 2007; Kazemi and Ameri, 2012b; Zuliana *et al*., 2008). Consequently, it hastens flower senescence and reduction of flower vase life span (Chutichudet *et al.,* 2011; Kazemi *et al*., 2012c). Postharvest senescence is also affected by reduction of the energy needed for synthesis reactions (Song *et al*., 2007).

Cut flower loses their freshness and quality both during handling and transportation. Due to high perishability, flower and foliage parts are vulnerable to huge postharvest losses. To preserve the best quality of flowers after harvest and to make them tolerant to fluctuations in environmental conditions, treatment with floral preservatives and various holding and pulsing solutions (Jain *et al.,* 2009). Many kinds of flowers can be forced into bloom from the bud stage. This means holding the flowers in the optimum atmosphere. This ideal atmosphere is accomplished with warm preservative solution, high humidity, and light. The preservative provides nutrients for respiration. Creating humidity can be accomplished by covering the flowers with a clear plastic bag or by misting, and this prevents dehydration of the buds and blossoms through transpiration. Light is important for photosynthesis which is required for the plant processes (Johnson, 1993). Therefore, keeping above point the present case study conducted to evaluate the response of various holding solutions on physical appearance and vase life of carnation (*Dianthus caryophyllus* L.) cut flower.

**Materials & Methods :**

A case study was conducted to evaluate the response of various holding solutions on physical appearance of carnation (*Dianthus caryophyllus* L.) cut flower in Horticulture Laboratory of School of Agricultural Sciences and Technology, RIMT University, Mandi Gobindgarh, Punjab, India. A case study consisting two concentration of sucrose (1 and 2%), $GA_3$ (3 and 6 mg/lit.) and ($Al_2(SO_4)_3$ (100 and 200 mg/lit.). In the case study $GA_3$ 6 mg/liter of water and $Al_2(SO_4)_3$ 100 mg/liter of water.

**Result & Discussion:**

The study showed significant effect of various holding solution on physical appearance and vase life of carnation flower at different days (6, 9, 12, 15 and 18) after harvesting and the physical appearance and vase life of carnation cut flower are presented in Figure. 1, 2, 3, 4, 5 and 6). Among the various holding solution, the holding solution of $GA_3$ 6 mg/ liter of water and $Al_2(SO_4)_3$ 100 mg/liter of water produced good physical appearance and vase life of carnation cut flower up to 18 days after harvesting.

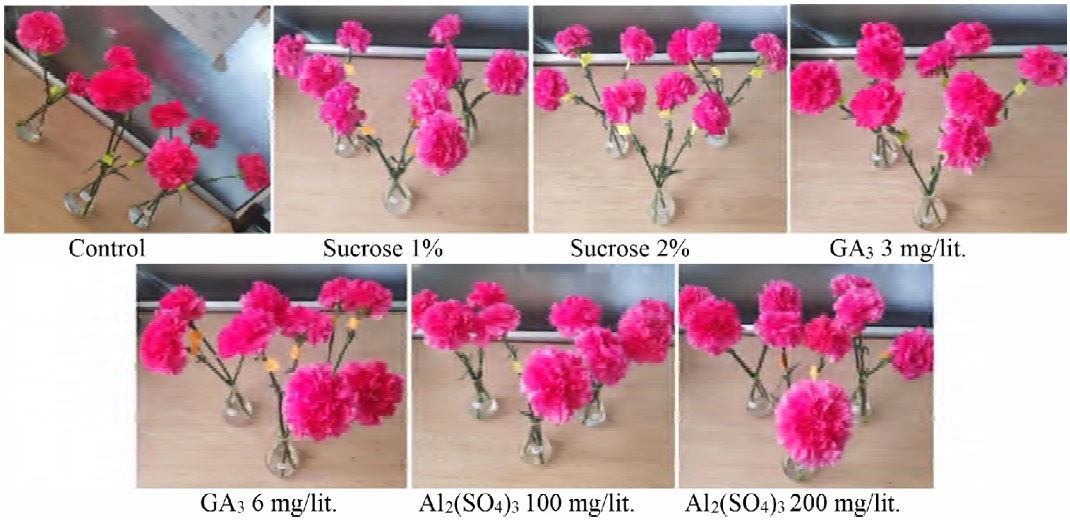


Figure 1. Response of various holding solutions on physical appearance of carnation (*Dianthus caryophyllus* L.) cut flower at 6 days after harvesting

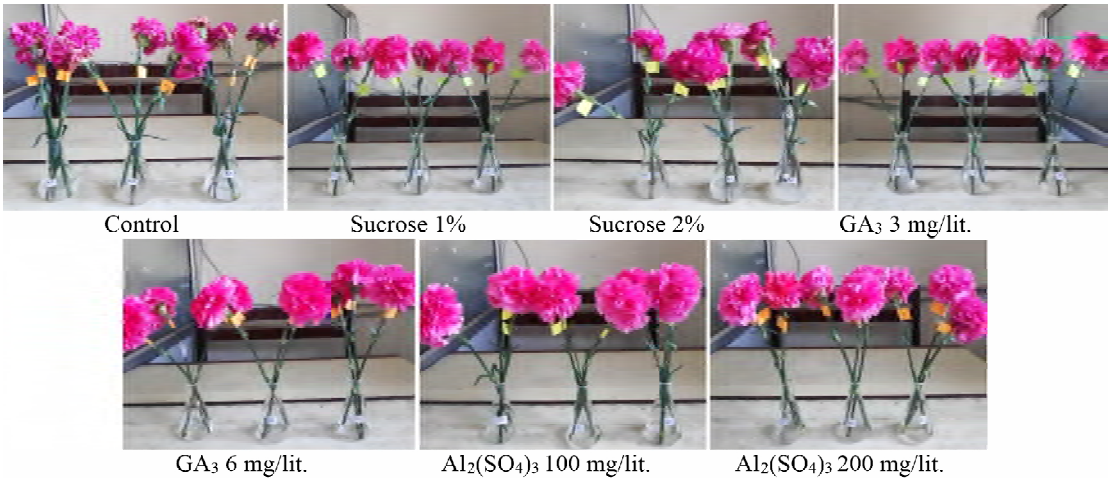


Figure 2. Response of various holding solutions on physical appearance of carnation (*Dianthus caryophyllus* L.) cut flower at 9 days after harvesting

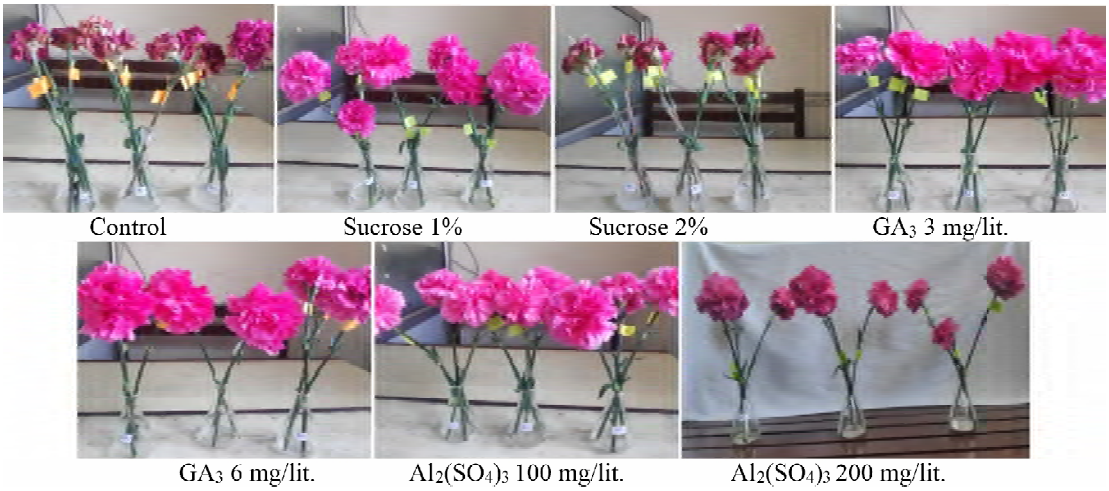


Figure 3. Response of various holding solutions on physical appearance of carnation (*Dianthus caryophyllus* L.) cut flower at 12 days after harvesting

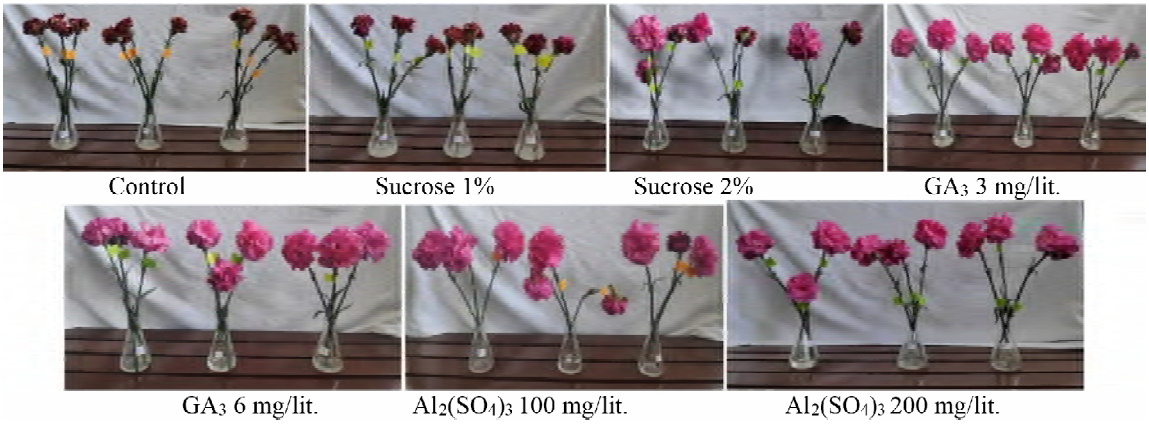


Figure- 4. Response of various holding solutions on physical appearance of carnation (*Dianthus caryophyllus* L.) cut flower at 15 days after harvesting

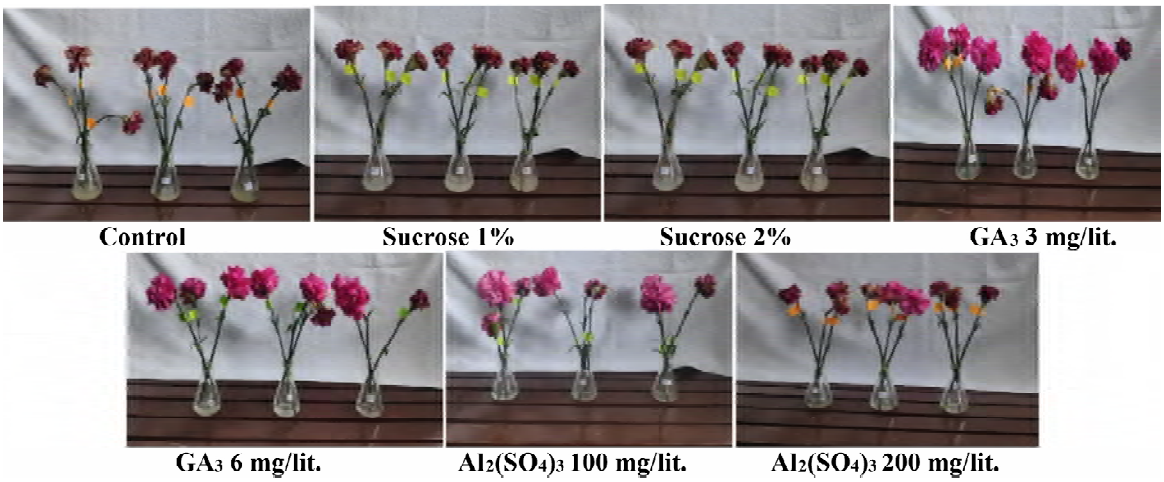


Figure 5. Response of various holding solutions on physical appearance of carnation (*Dianthus caryophyllus* L.) cut flower at 18 days after harvesting

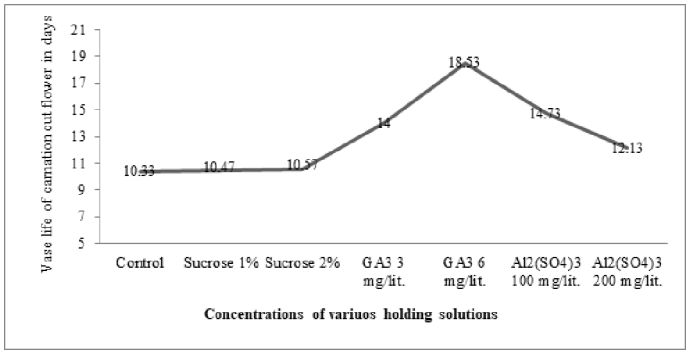


Fig.6. Response of various holding solution on vase life of carnation (*Dianthus caryophyllus* L.) cut flower

Aluminium sulfate is extensively used as a biocide for cut roses and many other cut flower species (Liao *et al.*, 2001). It has also been reported to improve keeping quality and vase life of cut roses by stabilizing petal anthocyanin contents and lowering pH (Ichimura *et al.*, 2006). Sugars are the integral component of flower foods, providing essential carbohydrates to the cut stems and continuing metabolic processes necessary for extension of vase life. However, sugars must be used along with antimicrobial compounds to prevent microbial build up in the solutions (Van *et al.*, 1995). It is also acts as an antimicrobial agent in vase solution (Halvey and Mayak, 1981) by inhibiting of bacterial vessel blockage. It is in agreement with results of eustoma flowers that aluminum sulfate (150 mg/lit.) had increased water uptake and fresh weight of flowers (Liao *et al.*, 2001).

**Conclusion:**

The $GA_3$ increases calcium absorption, which not only reduced electrolyte leakage but also increased the mechanical stiffness of the stems and water absorption prevents bending of the neck. Therefore, longevity increased. Similar results were obtained by Mutui, (2001) in Alstroemeria cut flowers. $GA_3$ at different concentrations improved membrane stability index that led to better flower vase life. Similar effects on membrane stability index have been reported in gladiolus with BA and GA3 (Singh *et al.*, 2008) and in gladiolus with 5-sulfosalicylic acid (Ezhilmanthi *et al.*, 2007) .

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**Short Communication**

# Influence of Covid-19 on Indian Floriculture Sector

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**ABSTRACT**

Agriculture is the vital segment of any economy of our Ccountry. It is the primary sector which generates employment, so that the entire circle of economic circulation goes on. This sector is badly hit by the corona virus pandemic and subsequent lockdowns which ultimately affected the Indian economy. The lockdown is expected to flatten the infection curve and essential economic activities and services will be in place soon. The devastating impact of COVID-19 on the flower sector in India is visible even in regions where the virus has not affected people. This has been caused by the complete closure of the market as a result of the nationwide lockdown in the wake of the pandemic. The Departments of Horticulture in some provinces are starting to undertake surveys to assess the losses in this sector. A detailed COVID-19 impact assessment urgently needed on the floriculture sector. This article discusses some of the impacts of floriculture during lockdowns.

**Key words:** COVID-19, Floriculture, pandemic, economy and employment.

## INTRODUCTION:

The novel Corona virus (COVID-19) pandemic has rapidly spread across the world, adversely affectined the lives and livelihoods of millions across the globe. First infection of corona virus was reported in India on 30 January 2020 while, it is a highly contagious disease and the much-needed nation-wide lockdown which was enforced, starting 25 March 2020 in order to suppress the spread of COVID-19 pandemic. During the initial few weeks, the restrictions were strict and all non-essential activities and businesses, including retail establishments, educational institutions, places of religious worship, across the country were prohibited from operating (Anonymous, 2020a).

Flowers are symbol of beauty, love and tranquility, associated with mankind from the dawn of civilization. Besides their aesthetic value, they are important for their economic uses, such as for cut flower, loose flower, nutraceuticals, extracting oil and pigments, etc. In India flowers are sanctified and are commonly used in worshipping in deities in our homes and temples. For many centuries, flowers play an important role in each and every occasions of life and no social function is considers complete without use of flowers. In India, flowers are sold in the market for various purposes but traditionally as loose after making into garlands. Flowers play an essential role in people's celebrations and everyday lives. Weddings, graduations, festivals like Deepawali, Durga Pooja, Mother's Day, St. Valentine's Day, funerals, Easter and Christmas are all peak periods of demand for flowers and plants. The demand for flowers increases which helps in dragging up sales to large scale (Bose, 1999).

## GLOBAL SCENARIO:

As a result, the global flower industry is continuously increasing, driving the production, trading and consumption to grow year after year. But in the year 2020-21, due to COVID-19 virus outbreak, every country announced the lockdown. The overseas export and import of flower produce has been completely stopped. Only essential commodities have been allowed to transport but flowers come under nonessential commodity that's why floriculture industry suffered huge losses during lockdown period. From this study, it has found that due to COVID-19 pandemic, sales and production of flowers were adversely affected. It is decreasing day by day and many countries have stopped production and sales of flowers. To avoid the spread of corona virus most of the countries have imposed complete lockdown. Due to complete lockdown, export and import has totally stopped. To stay alive during pandemic flower is never being first priority to anyone. As the flowers are non-essential commodity, customers give last preference to flowers. In many countries the production of flowers has significantly decreased consequently the rate of flowers to sale it in the market has been decreased drastically (Gaikwad and Tambe, 2021).

**INDIAN SCENARIO:**

The flower industry in India caters to a huge domestic market and provides source of revenue to workers and farmers in rural areas for several months in a year. India has faced devastating impact of COVID-19 on the flower sector is visible even in those areas where the virus has not affected people. This has been caused by the complete collapse of the market as a result of the nationwide lockdown in the wake of the pandemic. As per IMARC, a market research company, the Indian floriculture market was worth INR 18,870 crores in 2019. The market was projected to reach INR 55,790 crores by 2025, with a compound annual growth rate of 19.8% during 2020-2025. However, the growth prospects appear quite bleak now, as the sector confronts disaster (Anonymous, 2020b).

**Impact on India's floriculture sector during Covid-19 -** In India, the lockdown took place into two phases i.e. Phase-I (25 March to 14 April 2020) and Phase II (15 April to 3 May 2020) and all social gatherings, cultural activities, religious foundations and the closing of the hotel and hospitality industry have restricted and badly destroyed the law of demand for flowers as well as flower products. Indian government allowed to open only retail shops from 25 April 2020 with some restrictions will help restart the supply chain though to a limited extent; thus, some states like West Bengal have allowed flower markets to open for fewer hours. But it is impossible that the demand would be same as pre-lockdown levels. Indian flower industry provides supports livelihood to workers and farmers in rural areas for several months in a year.

In 2019, the estimated value of Indian flower market is Rs.18,870 crores and the market was designed to reach Rs. 55,790 crores by 2025, with a compound annual growth rate of 19.8% from 2020 to 2025. During 2018-19, 19,726.57 MT of flowers having the worth of Rs. 571.38 crores were exported from India (Anonymous, 2020c). APEDA has suggested a COVID-19 advisory i.e Indian exporters could exploit the supply gap of flowers from African countries to European markets and growth. However, the losses from the domestic market have a greater impact since an estimated 99% of the flowers grown in the country are traded domestically. Still, the losses from the domestic market have a greater impact since an estimated 99% of the flowers grown in the country are traded domestically (Chetan and Yogish, 2020).

**CASE STUDIES**

Based on secondary data, Gaikwad and Tambe (2021) revealed that flower growers faced much more losses during the lockdown. One grower says due to lockdown markets were closed so that they threw flowers on the street. But the cattle can be fed on them and villagers are taking them as cattle feed.

Another study revealed that temples were closed for months and no-frill marriage ceremonies becoming a norm in the midst of the Covid-19 pandemic, marigold cultivation in the country has gone down by about 60-70 per cent (Jadhav, 2020).

Kasabe (2020) stated that due to the lockdown, rose growers from Maharashtra suffered the losses up to Rs. 60 lakh per day. Therefore, most of the events like marriages, birthdays, various festivals etc. were cancelled. Due to lockdown, not only export market but also domestic markets were closed. The main domestic market like Delhi, Bengaluru, Hyderabad, Indore, Mumbai, etc. were closed due to that demand of the flowers in the market has been decreased.

In another investigation, tonnes of marigold, chrysanthemums, lily, jasmine and other locally grown flowers that were transported to wholesale markets in the city just before lockdown mostly destroyed because there were no buyers. Floriculture farmers grow variety of flower according to the festivals, cultural activities, religious foundations and number of events or orders but the closing of the hotel and hospitality industry, has destroyed the demand for flowers (Maitreyi, 2020).

Verma and Kulkarni (2020) reviewed of famers and traders about the lockdown losses in floriculture business. Mostly Jasmine flower comes in harvesting in the mid-March. But due to lockdown, flowers were not able to be sold in the market, hence, the famers suffered huge losses during this period. The impact of the Covid-19 pandemic has had a huge impact on floriculture in the Nilgiris. Nilgiri's Farmers say, the main export hub in Bangalore has been closed because there are no buyers so many farmers destroyed their flower crop due to lack of buyers. According to officials from the Department of Horticulture, there are 103 farmers who depend on floriculture in the Nilgiris.Most of them had switched over from growing tea to floriculture over the last few years. The impact of COVID-19 pandemic however, has forced many farmers, who had been growing flowers, to switch to other crops due to heavy losses.

**CONCLUSION:**

Corona virus will hit long lasting effect on each and every business. To avoid adverse impact on the cut flower business, many countries have stopped exporting flowers and concentrating only on essential goods. Also the buying behavior of consumer has been changed. Consumer is focusing on only essential goods and flowers are not the essential item. Flowers are perishable product. The sale has

been stopped but we cannot stop growth of flowers. Therefore, it needs to be stored in cold storage. Flower can be stored for 7-8 days in cold storage but due to spread of corona virus all boundaries of country were sealed and will not open till spread of corona stops. Due to which, there is a huge loss of flowers all over the world. Now in this situation, government has to take some supportive action towards florists. If our government extends financial support to growers it will generate the foreign currency and it will be ultimately helpful to strengthen our economy.

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## NEWS / VIEWS / EVENTS

**Events Organized:**

**Training Programmes**

As a part of ongoing scientific activities organized by the Foundation following training programmes were organized at the training centre.

1. An internship programme was organized on **Home Gardening & Bonsai Technique** on May 13-23, 2022 at Bagvani, Lucknow. The trainees learnt about the techniques of Bonsai preparation besides its maintenance. Technical information on home gardening comprising selection of plants, planting, potting mixture and display techniques were provided followed by demonstration and hands-on training.
2. One Training programme was organized on **Comprehensive Capsule Course on Ornamental Horticulture** on July 4-8, 2022 at Bagvani, Lucknow. Five persons participated in the training programme. Information on home gardening comprising selection of plants, planting, potting mixture and display techniques were provided followed by demonstration and hands-on training on Bonsai technique. Dr. B.K. Banerji and Dr. R.K.Roy acted as Resource persons. Field trips were organized to various locations in support of the theoretical aspects.

# GUIDELINES TO AUTHORS

**General:**

'**The Journal of the Greens & Gardens'** is a research journal in the field of Floriculture and Landscaping for the publication of research papers from Indian / foreign Scientists / Professors / Research Scholars. In addition, invited research papers / review papers from reputed Scientists from institutes of India / abroad are also be included. It is a quarterly journal published in April, July, October and January of every year.

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**Name & Address –** Name(s) of the author (s) and address of the institute / university should be mentioned below the title followed by E. mail address of the corresponding author.

**Abstract –** Clearly written mentioning the objectives, methods, results and conclusion within 150 words**.**

**Key words –** Five key word indicating main content of the paper and abstracting purpose.

**Main Text** – This should be well written about the research work done under following headings – INTRODUCTION, MATERIALS & METHODS, RESULTS & DISCUSSIONS, CONCLUSION, ACKNOWLEDGEMENT.

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- Monotti M. 2014. Growing non-food sunflower in dry land conditions. *Italian J. Agronomy* **8**:3-8.
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- Dissemination of scientific and technical knowledge on greens (plants) and gardens (plantation) among the public in various ways for beautification and amelioration of environment.
- Publication of scientific journals / books / bulletins on greens and gardens to serve scientific community in wider perspective.
- Organization of awareness / training programmes, workshops, group discussions etc., on various aspects of greens and gardens to sensitize general public for their best use

## Greens & Gardens

### Greens

Plants are integral part of our daily life. The relationship between plants and human beings is very old. With the passage of time, and modernization of our social life, we have become more dependent on plants for pleasure, aesthetics, food, medicine and environmental amelioration. Therefore, always protect plants (greens) for our own survival.

### Gardens

Garden is a place for pleasure and utility. The beauty of flowers and plants in a garden help to reduce our mental stress. Today's modern life is very busy and our involvement to work and profession have increased in manifold. There is hardly any scope for relaxation resulting easy victimization of fatigue and boredom. Here comes the role of greens and gardens. They serve as a true activation of our mind and gradually rejuvenate body by induction of fresh energy. Therefore, the importance of plants, flowers and their influence on our daily life is immense and can't be ignored.

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