RESEARCH ARTICLE

Establishment of Herbal Garden in the Galgotias University Campus - An *Ex-situ* Conservation Approach

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Abstract

Herbal gardens are a rich source of plant-based medicines and their derivatives. Both in urban and rural locations, herbal plants have an important role in traditional medicine. The development of herbal garden includes propagation, multiplication, research, education, and extension activities as well. In the present study, we took herbal plants from different nurseries of Noida and Greater Noida of Gautam Buddha Nagar district, Uttar Pradesh and developed herbal garden in the Galgotias University campus. The herbal garden has approximately 45 different plants, including shrubs (22), trees (13), herbs (9) and grass (1) etc. The geotagged photographs of each herbal plant were captured using GPS map camera. The *Ex-situ* conservation of herbal garden in Galgotias University would help and motivate faculties and students of the university, to undertake further research on medicinal plants.

Keywords: Herbal garden, *Ex-situ* conservation, Biodiversity, National Capital Region.

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Introduction

The use of herbal medicines to treat disease and boost immunity is now increasing throughout the world (Sailaja *et al*., 2021; Bhatt *et al*., 2021). India has a rich history of excellent native plants with acknowledged therapeutic use (Kala *et al*., 2006; Bhatt *et al*., 2021). The conventional health care system depends heavily on medicinal plants, which are also essential to the world's biodiversity (Maunder *et al*., 2001). Most of herbal plants utilized in herbal remedies are gathered from wild sources (Petrovska, 2012). The tools and methods used for plant collection are frequently not scientific, which causes the plant species to be on the verge of extinction (Downey, 2016). Many herbal plants have now been classified as rare, endangered, or threatened due to widespread over-exploitation of the herbal flora, which permanently reduces biodiversity (Gowthami *et al*., 2021). *Ex-situ* conservation is a method for preserving biological diversity that focuses on all levels of biodiversity, including genetic, species, and ecological diversity (Borokini *et al*., 2010). Before being formally adopted by the Convention on Biological Diversity, which was signed in 1992 in Rio de Janeiro, its concept had already been devised (Antofie, 2010). *Ex-situ* conservation is typically used as an additional approach to support In-situ conservation, which refers to the preservation of biological diversity in its natural environments (Kjaer, 2001). In some circumstances, *Ex-situ* conservation management may be essential to a conservation strategy, but it may also be of secondary importance in others (Reid *et al*., 2013). *Ex-situ* conservation broadly refers to a range of operations, including controlling captive populations, educating public, promoting research projects, and worked in conjunction with *In-situ* efforts (Melfi, 2012). Biological resources (plants, animals, and microbes) are studied and conserved using a variety of methodologies, including zoos, captive breeding facilities, aquariums, botanical gardens, and gene banks (Bhatt *et al*., 2013). There is an urgent need for extensive, focused efforts to maintain the flow of resources from therapeutic plants (Yu *et al*., 2010; Swart and Dixon, 2009). Herbal gardens have the potential to be extremely important for the *Ex-situ* conservation of medicinal and aromatic plants (Patel, 2015). A National Medicinal Plant Board (NMPB) plan for developing an herbal garden aims to preserve the medicinal and aromatic plants for future generations and to multiply and propagate those (Chen *et al*., 2010). The use of herbal plants has long played a significant role in India's rural and tribal communities' socio-cultural and medical landscapes (Uniyal *et al*., 2006). An illustration of an *Ex-situ* conservation technique for rare, endangered, and threatened medicinal and aromatic plants in herbal gardens (Lakshman, 2016). These plants are recognized and brought into the herbal garden for the goal of conservation and proliferation.

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About the study area

The Galgotias University Campus is located opposite the Buddha International Circuit on the Yamuna Expressway at longitude 77°32'31" east and latitude 28°21' 58" north. The sub-tropical monsoon climate of this area has three distinct seasons: cold from November to February, hot from March to the middle of June, and rainy season from the middle of June to the month of September. In the chilly month, the daytime temperature range between 13°C and 14.5°C. June is the hottest month, with temperatures between 36°C and 46°C (Attri and Tyagi, 2011).

Preparation of the Area

Preparation of land, selection of a suitable location, and establishment of the herbal garden is necessary for its development as in the University campus. The herbal garden is designed as per the climatic of conditions and its preparations are completed by removing woody weeds. The land are deeply ploughed and prepared slope formation as per the land condition. These processes are required for raised beds for each species of the herbal garden.

Transplantation of Plants

The collected plants and its parts are grown in the raised beds after being distance managed from plant to plant and row to row. The vegetative material, such as bulb, stems, and leaves, are used to propagate the sapling. The modified vegetative plant parts, such as bulbs, tubers, rhizomes, corms, and seeds are grown in the herbal garden.

Monitoring of the Plants

All efforts are prepared to promote good growth and development of the herbal plants. The herbal plants are monitored daily to assess their water requirement, fertilizer, mulching, and removal of unwanted weeds etc. The seedlings are shielded from intense sunlight by covering them with green nylon net.

Plants in the herbal garden

A few shrubs, including the following, exist in the herbal garden area: *Annona reticulata* (L.), *Azadirachta indica* A.Juss. (Fig. 27), *Bougainvillea spectabilis* Willd, *Calotropis gigantea* (L.) Dryand (Fig. 23), *Calotropis procera* (Aiton) W.T.Aiton, *Carissa carandas* L., *Cestrum nocturnum* L., *Citrus×sinensis* (L.) Osbeck, *Citrus limon* (L.) Osbeck (Fig. 12), *Hibiscus rosa-sinensis* L. (Fig. 18), *Jasminum sambac* (L.), Aiton, *Laurus nobilis* L (Fig. 3)., *Lawsonia inermis* L. (Fig. 2), *Murraya koenigii (*L.) Sprengel (Fig. 4), *Origanum majorana* L. (Fig. 7; Fig. 25), *Phyllanthus emblica* L. (Fig. 8), *Psidium guajava* L. (Fig. 22; Fig. 28), *Punica granatum*

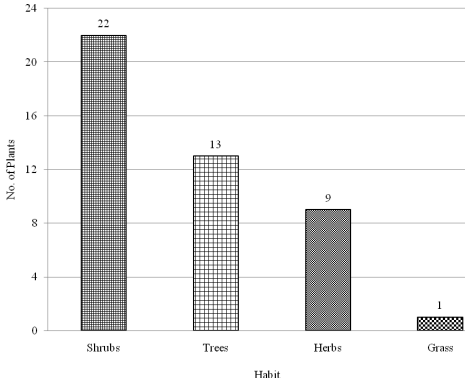

Fig. 1: The status of the number of plants in the Glgotias University herbal garden.

Table 1: Plants in herbal garden area in Galgotias University, Greater Noida.

S. No.	*Scientific Name*	*Families*	*Habit*	*Common Name*	*Conservation status*	*Medicinal Uses*
1.	*Aegle marmelos* (L.) Corrêa	Rutaceae	Tree	Bael	Near Threatened	The bael plant has incredible therapeutic potential in all of its sections. The herbal medical formulations of bael are used to treat respiratory ailments, peptic ulcers, chronic diarrhea, dysentery, and laxatives for astringency.
2.	*Aloe vera* (L.) Burm.f.	Asphodelaceae	Shrub	Aloe	-	Over 20 different minerals that are all necessary for human health may be found in *Aloe vera*. Eight of the 22 amino acids that the human body needs to function properly are referred to as "essential" amino acids since the body cannot produce the others. All eight of these essential amino acids are present in *Aloe vera*, along with 11 of the 14 "secondary" amino acids. Vitamins A, B1, B2, B6, B12, C, and E are present in *Aloe vera*. *Aloe vera*is revered in India for its beneficial benefits on the skin, which are said to help maintain young. So, it is also known as ghee Kunvar or ghee Kumari.
3.	*Annona reticulata* (L.)	Annonaceae	Shrub	Custard Apple	Least Concern	Plants from the *Annona reticulata genus* are recognized to have a variety of therapeutic uses. They have several historical applications for treating conditions including epilepsy, diarrhea, bacterial infections, fever, cardiac issues, etc. The fruits' anti-oxidant content is proven to improve digestive health and lower blood pressure.
4.	*Azadirachta indica* A.Juss.	Meliaceae	Shrub	Neem	Least Concern	In addition to treating lice, the leaf extract is utilized to reduce dental plaque. Neem includes compounds that may lower blood sugar levels, treat stomach ulcers, prevent pregnancy, eliminate germs, and stop plaque from accumulating in the mouth.
5.	*Bambusa ventricosa* McClure	Poaceae	Grass	Buddha Belly Bamboo	-	Internal parasites discomfort, and gastrointestinal issues are treated with vulgaris. In Trinidad and Tobago, it is used for skin issues. Bamboo is employed as an emmenagogue, an abortifacient, an appetizer, a remedy for respiratory illnesses, and a treatment for gonorrhea in Nigerian folk medicine.
6.	*Bougainvillea spectabilis* Willd	Nyctaginaceae	Shrub	Great Bougainvillea	-	In several Nations, the tribal people have employed this plant's aqueous extract and decoction as a method of fertility control. It has also been demonstrated to have anti-cancer, anti-diabetic, anti-hepatotoxic, anti-inflammatory, anti-hyperlipidemic, antibacterial, antioxidant, and antiulcer effects.
7.	*Calotropis gigantea* (L.) Dryand	Apocynaceae	Shrub	Crown Flower	-	It can ease minor to severe skin problems as well as neurological, respiratory, and digestive issues. It has been proven to be quite helpful in the treatment of fevers, nausea, vomiting, and diarrhea. The herb's milky latex is utilized to prevent cancer. Additionally, it works well as a remedy for treating snake bites.

8.	*Calotropis procera* (Aiton) W.T.Aiton	Apocynaceae	Shrub	Rubber Bush	Least Concern	Akra, Akanal, and Madar are a few of its common names. The antidote for snake bite, sinus fistula, rheumatism, mumps, burn injuries, and bodily ache is reported to be the leaves of *Calotropis procera*. To cure jaundice, *Calotropis procera* leaves are also employed.
9.	*Carissa carandas* L.	Apocynaceae	Shrub	Karonda	-	An Ayurvedic plant known as Karamarda- *Carissa carandas* is used to cure acid reflux, indigestion, sores both fresh and infected, skin conditions, urinary problems, and diabetic ulcers. *Carissa carandas* L. is her Latin name.
10.	*Cassia fistula* L.	Fabaceae	Tree	Amaltas	Least Concern	There are anti-inflammatory effects in *Cassia fistula* L. The hepatoprotective and antitussive properties of *Cassia fistula* L. It has antifungal and antibacterial effects. The plant *Cassia fistula* L. is used to treat digestive disorders and wounds.
11.	*Catharanthus roseus* (L.) G.Don	Apocynaceae	Herb	Periwinkles	-	Plant is used in the treatment of diabetes and cancer; septic wounds are treated with root paste; fever is treated with root decoction; menorrhagia is treated with leaves; and blood dysentery is treated with leaf juice.
12.	*Cestrum nocturnum* L.	Solanaceae	Shrub	Night Jessamine	Least Concern	The anti-inflammatory, anti-hyperlipidemic, cardio-protective, analgesic, antibacterial, anti-convulsant, and insecticidal properties of night blooming jasmine. In Central America and the Caribbean, a decoction of the leaves is used as a moisturizer for irritated skin.
13.	*Cinnamomum verum* J.Presl	Lauraceae	Tree	Cinnamon	-	A popular medicinal plant for a range of pharmacological uses is *Cinnamomum verum*. This plant is present in almost all medicinal systems across the world. There have been claims made about the anti-diabetic, antibacterial, antioxidant, anti-inflammatory, and anticancer properties of Cinnamomum verum.
14.	*Citrus* × *sinensis* (L.) Osbeck	Rutaceae	Shrub	Sweet Orange	-	Ailments include constipation, cramps, colic, diarrhea, bronchitis, TB, cough, cold, obesity, menstruation disorders, angina, hypertension, anxiety, depression, and stress have all been treated with it historically.
15.	*Citrus* × *sinensis* (L.) Osbeck	Rutaceae	Tree	Orange	-	Oranges' vitamin C benefits your health in a variety of ways, including: prevents harm to your cells helps your body produce collagen, a protein that offers you smoother skin and aids in wound healing. enables better iron absorption to combat anemia.
16.	*Citrus limon* (L.) Osbeck	Rutaceae	Shrub	Lemon	Least Concern	Lemons have several health advantages due to their high vitamin C content, soluble fiber content, and plant components. Lemons may help you lose weight and lower your chances of heart disease, cancer, anemia, kidney stones, digestive problems, and kidney stones.
17.	*Clitoria ternatea* L.	Fabaceae	Herb	Butterfly Pea	-	As a nootropic, stress reliever, anxiety reduction, antidepressant, anticonvulsant, tranquilizer, and sedative, traditional Ayurvedic medicine has been utilized for millennia.
18.	*Cymbopogon citratus* (DC.) Stapf	Poaceae	Herb	Lemon Grass	-	This oil works best in hot conditions to reduce body temperature and to energize the spirit and intellect. Other health advantages include relief from headaches, muscular cramps, spasms, rheumatisms, nausea, menstrual issues, and poor digestion.
19.	*Delonix regia* (Boj. ex Hook.) Raf	Fabaceae	Tree	Gulamohar Tree	Least Concern	The *Delonix regia* tree has a wide range of therapeutic benefits. It possesses wound healing qualities in addition to antibacterial, anti-inflammatory, antifungal, antimicrobial, antioxidant, and antimalarial activities. The *Delonix regia* tree has anti-diabetic leaves.
20.	*Dracaena trifasciata* (Prain) Mabb	Asparagaceae	Shrub	Snake Plant	-	Ringworm and other fungal illnesses are treated using the plant. On infected wounds and sores, the leaf sap is immediately administered. They may eliminate harmful air contaminants, which purifies the air.
21.	*Ficus racemosa* L.	Moraceae	Tree	Indian Fig Tree	Least Concern	It has received a lot of attention for the treatment of inflammatory diseases, diabetes, diarrhea, dysentery, and biliary problems.
22.	*Hibiscus rosa-sinensis* L.	Malvaceae	Shrub	China-Rose	-	Originally from tropical Asia, *hibiscus* rosa-sinensis is a blooming plant. *Hibiscus* teas produced from its flowers, leaves, and roots are frequently ingested. In addition to being consumed in moderation, *hibiscus* is also utilized as a herbal remedy to treat cancer development, high cholesterol, and hypertension.
23.	*Hibiscus syriacus* L.	Malvaceae	Herb	Hibiscus	-	In China, the *Hibiscus* syriacus L. flower is a well-known TCM remedy and healthy food that has been used to cure hemorrhoids, vaginal discharge, and diarrhea.
24.	*Jasminum sambac* (L.) Aiton	Oleaceae	Shrub	Arabian Jasmine	-	Asminum sambac has historically been used as an analgesic, antidepressant, anti-inflammatory, antiseptic, aphrodisiac, sedative, expectorant, and to treat dysmenorrhea, amenorrhea, ringworm, leprosy, and skin ailments.

25.	*Kalanchoe pinnata* (Lam.) Pers.	Crassulaceae	Herb	Cathedral Bells	-	The herb *kalanchoe pinnata* is frequently used to heal stomach ulcers.
26.	*Laurus nobilis* L.	Lauraceae	Shrub	Bay Tree	Least Concern	The culinary and food industries make good use of the important flavoring ingredient Laurus nobilis. This plant is utilized in folk medicine for the treatment of digestive disorders as well as for stomachic and carminative medicines.
27.	*Lawsonia inermis* L.	Lythraceae	Shrub	Henna	Least Concern	The analgesic, anti-inflammatory, hepatoprotective, and hypoglycemic characteristics of Lawsonia inermis are due to this plant. Additionally, the plant's cytotoxic, immune-stimulating, antibacterial, and antifungal properties have been observed.
28.	*Mangifera indica* L.	Anacardiaceae	Tree	Mango	Data Deficient	Different components of the plant are used as a dentrifrice, antiseptic, astringent, diaphoretic, stomachic, vermifuge, tonic, laxative, and diuretic as well as to treat diarrhea, dysentery, anemia, asthma, bronchitis, cough, hypertension, insomnia, rheumatism, toothache, leucorrhoea, hemorrhage, and piles.
29.	*Mentha piperita* L.	Lamiaceae	Herb	Mint	-	In addition to its potential benefits for tension headache, nipple fissures, infantile colic, infantile dyspepsia, functional dyspepsia, irritable bowel syndrome, pruritus gravidarum, hirsutism, and athletic performance, peppermint may also help with stomach hyper motility.
30.	*Millettia pinnata* (L.) Panigrahi	Fabaceae	Tree	Pongame Tree	Least Concern	In addition to treating bleeding issues, millettia *pinnata* flower is used to alleviate piles. Fruits from this plant are used to cure tumors and stomach ulcers. Leprosy, a cold, a cough, and diarrhea can all be treated with the leaf juice.
31.	*Murraya koenigii (*L.) Sprengel	Rutaceae	Shrub	Curry Leaf Tree	Least Concern	The green leaves of *M. koenigii* are used to treat edema, bruising, piles, diarrhea, inflammation, itching, and new wounds. Somewhat purgative are the roots. They are energizing and used to treat typical bodily ailments.
32.	*Ocimum basilicum* L.	Lamiaceae	Herb	Sweet Basil	-	The herb sweet basil, also known as *Ocimum basilicum*, has been used traditionally as a medicine to treat renal problems, warts, worms, diarrhea, and headaches.
33.	*Ocimum tenuiflorum* L.	Lamiaceae	Herb	Holy Basil	-	This plant is well-known in Ayurveda for its healing and enlightening qualities, which include assisting with conditions like cough, asthma, diarrhea, fever, dysentery, arthritis, eye illnesses, indigestion, stomach problems, etc.
34.	*Origanum majorana* L.	Lamiaceae	Shrub	Sweet Marjorum	-	In traditional and folkloric medicine, Origanum *majorana* L., often known as sweet marjoram, has been used to treat a range of illnesses, including gastrointestinal, ophthalmic, nasopharyngeal, respiratory, cardiac, rheumatologic, and neurological issues.
35.	*Phyllanthus emblica* L.	Phyllanthaceae	Shrub	Indian Gooseberry	Least Concern	The fruit, which has been used in Ayurveda as a strong rasayana and in traditional medicine to treat diarrhea, jaundice, and inflammation, is the most commonly utilized portion of the plant for medicinal purposes.
36.	*Plumeria alba* L.	Apocynaceae	Tree	Frangipani	Least Concern	*Plumeria alba* is frequently used to treat bacterial, fungal, and viral illnesses including herpes, scabies, and fungal infections. *Plumeria alba* is derived from the leaves, bark, and flowers. The *P. alba* plant's components have demonstrated positive antihelmintic, antipyretic, and antirheumatic activities.
37.	*Prosopis cineraria* (L.) Druce	Fabaceae	Tree	Ghaf	-	For ruminant and animal feed, leaves and pods are used. Leprosy, dysentery, asthma, leucoderma, dyspepsia, and earaches are just a few of the problems that Prosopis cineraria is frequently used to treat in traditional medicine.
38.	*Psidium guajava* L.	Myrtaceae	Shrub	Guava	Least Concern	Although guava has many medical benefits, it is the most widely used and well-liked traditional treatment for gastrointestinal diseases such diarrhea, dysentery, stomachaches, and indigestion. Guava is used for these conditions all over the world.
39.	*Punica granatum* L.	Lythraceae	Shrub	Promegranate	Least Concern	Pomegranate, also known as *Punica granatum* L, is one of the medicinal plants from the Mediterranean region that has been used for centuries to cure ulcers, diarrhea, and male infertility.
40.	*Putranjiva roxburghii* L.	Putranjivaceae	Tree	Putranjiva	Least Concern	The Ayurvedic herb *putranjiva roxburgii* is used to cure eye conditions, burning sensations, elephantiasis, difficult urination, azoospermia, and recurrent miscarriages. The word Putranjivaka means something that encourages or creates offspring, something that encourages fertility in both men and women.
41.	*Rosa* × *damascena* Mill	Rosaceae	Shrub	Damask Rose	-	*R. damascena* has historically been used to cure constipation, digestive issues, menstrual bleeding, stomach and chest discomfort, and to strengthen the heart.

42.	*Saraca asoca* (Roxb.) Willd	Fabaceae	Tree	Ashoka	Vulnerable	The Indian medical system has long utilized *Saraca asoca* to treat a variety of conditions, including fever, pain, urogenital tract illnesses, and uterine, genital, and other reproductive diseases in women.
43.	*Syzygium cumini* (L.) Skeels	Myrtaceae	Tree	Jamun	Least Concern	The bark is used to heal ulcers, biliousness, thirst, bronchitis, and asthma. It is also astringent to the intestines, digestive, and an anthelmintic. It also works well to purify blood.
44.	*Trachyspermum ammi* (L.) Sprague ex Turrill	Apiaceae	Herb	Caraway	-	The fruit has historically been utilized as a significant restorative agent for flatulence, atonic dyspepsia, diarrhea, abdominal tumors, abdominal discomfort, piles, and bronchial issues, lack of appetite, galactogogue, asthma, and amenorrhoea. It also has stimulant, antispasmodic, and carminative effects.
45.	*Withania somnifera* (L.) Dunal	Solanaceae	Shrub	Ashwagandha	-	The plant *Withania somnifera*, also called Ashwagandha, is referred to as the Indian ginseng. It can be used medicinally to treat a variety of CNS illnesses, including stress management, Alzheimer's and Parkinson's disease, cerebral ischemia, epilepsy, tardive dyskinesia, and tardive dyskinesia.

Fig. 2: *Lawsonia inermis* L.

Fig. 3: *Laurus nobilis* L.

Fig. 4: *Murraya koenigii* (L.)Sprengel

Fig. 5: *Aegle marmelos* (L.) Corrêa

Fig. 6: *Clitoria ternatea* L.

Fig. 7: *Origanum majorana* L.

Fig. 8: *Phyllanthus emblica* L.

Fig. 9: *Clitoria ternatea* L.

Fig. 10: *Cymbopogon citratus* (DC.) Stapf

Fig. 11: *Rosa* × *damascena* Mill

Fig. 12: *Citrus limon* (L.) Osbeck

Fig. 13: *Trachyspermum ammi* (L.) Sprageex Turrill

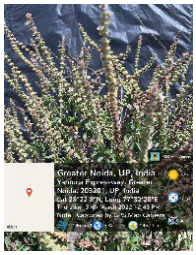

Fig. 14: *Ocimum tenuiflorum* L.

Fig. 15: *Aloe vera* (L.) Burm.f.

Fig. 16: *Hibiscus rosa-sinensis* L.

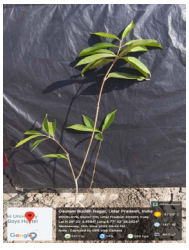

Fig. 17: *Syzygium cumini* (L.) Skeels

Fig. 18: *Hibiscus rosa-sinensis* L.

Fig. 19: *Prosopis cineraria* (L.) Druce

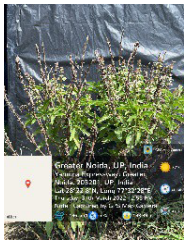

Fig. 20: *Ocimum basilicum* L.

Fig. 21: *Catharanthus roseus* (L.) G.Don

Fig. 22: *Psidium guajava* L.

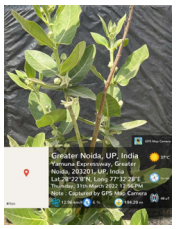

Fig. 23: *Calotropis gigantea* (L.) Dryand

Fig. 24: *Catharanthus roseus* (L.) G.Don

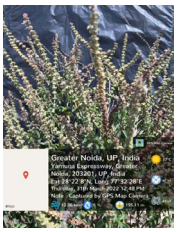

Fig. 25: *Origanum majorana* L.

Fig. 26: *Plumeria alba* L.

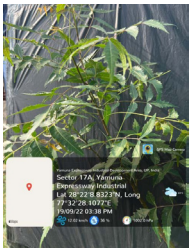

Fig. 27: *Azadirachta indica* A. Juss.

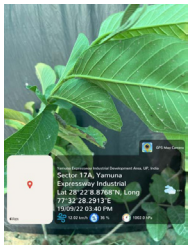

Fig. 28: *Psidium guajava* L.

L., *Rosa×damascena* Mill (Fig. 11), *Withania somnifera* (L.) Dunal, *Aloe vera* (L.) Burm.f. (Fig. 15), *Dracaena trifasciata* (Prain) Mabb, and grass species is *Bambusa* ventricosa McClure etc. The tress is less in numbers as compared to shrubs, but a few tree species are: *Aegle marmelos* (L.) Corrêa (Fig. 5), *Cassia fistula* L., *Cinnamomum verum* J.Presl, *Citrus×sinensis* (L.) Osbeck, *Delonix regia* (Boj. ex Hook.) Raf, *Ficus racemosa* L., *Mangifera indica* L., *Millettia pinnata* (L.) Panigrahi, *Plumeria alba* L. (Fig. 26), *Prosopis cineraria* (L.) Druce (Fig. 19), *Putranjiva roxburghii* L., *Saraca asoca* (Roxb.) Willd, *Syzygium cumini* (L.) Skeels (Fig. 17), etc. The herbs are as: *Catharanthus roseus* (L.) G.Don (Fig. 21; Fig. 24) *Clitoria ternatea* L. (Fig. 6; Fig. 9), *Cymbopogon citratus* (DC.) Stapf (Fig. 10), *Hibiscus syriacus* L., *Hibiscus syriacus* L., *Kalanchoe pinnata* (Lam.) Pers., *Mentha piperita* L., *Ocimum basilicum* L. (Fig. 20), *Ocimum tenuiflorum* L. (Fig. 14), *Trachyspermum ammi* (L.) Sprague ex Turrill (Fig. 13), etc., (Table 1).

Results And Discussion

Using appropriate techniques, the herbal garden is established in the Galgotias University Campus, Greater Noida, District Gautam Buddha Nagar, Uttar Pradesh in North India. The long-term presence and intended use, numerous significant, endangered, uncommon species of herbal plants were introduced. Such a structure of this type has been constructed and given the name Herbal Garden for the channel under the development of the herbal garden. It has been crucial in the *Ex-situ* conservation of medicinal plants in the Indian state of Uttar Pradesh. A sustainable option for gathering, propagating, and preserving the various plants of traditional medicine and other significant plants is the cultivation of herbal plants (Chen *et al.*, 2016). The herbal garden was crucial to the *Ex-situ* conservation of herbs from various regions. It must be properly established and managed to ensure the long-term preservation of the plant species. The distribution of scientific knowledge about a variety of herbal plants requires important processes such as herbal data collection, plant identification, database creation, herbarium preparation etc. Additionally, it aids in the identification, continued cultivation, and preservation of valuable medicinal plants. The dominant families in the herbal garden area are: Fabaceae (6), Apocynaceae (5), Rutaceae (5) and Lamiaceae (4). In the herbal garden area 45 plants are introduced which includes shrubs (22) followed by trees (13), herbs (9), and grass (1) (Fig. 1). Pandey *et al.*, 2021 have worked on Institutional herbal gardens, they concluded that establishment of herbal gardens had more long term benefits which include, conservation of local biodiversity, soil and water, utilization of unfertile and wastelands, awareness about the herbal garden and medicinal plants. The campus herbal garden gave students continuous access to a variety of herbs and plants that are not easily available in the local community. The herbal garden served as a useful tool for teaching and learning because it helped with coursework giving by students an opportunity for hands-on learning, including creating goods for evaluations. Students felt that the direct physical engagement offered by the herbal garden elevated their understanding of the course topic beyond what a textbook could offer. The sensory learning opportunities the herbal garden offered thought to help students to learn. Additionally, students used the herbal garden to buy herbs for cooking and making tea and to provide to patients at the student clinic.

Conclusion

This study reveals that the establishment of herbal gardens in the Galgotias University campus has many benefits: 1. Increases the utilization of waste and unfertile land into herbal garden farms. 2. It conserves soil and water utilization. 3. It gives the students awareness about medicinal plants and their benefits. 4. This type of plans and establishment of herbal gardens increases the conservation of biodiversity and their imperishable use. The creation of the University campus herbal garden has been a fantastic journey of turning aspirations into tangible accomplishments. The garden has helped preserve medicinal

plants while acting as a community gathering place and a center for education. The herbal garden demonstrates the University dedication to supporting biodiversity conservation and promoting conventional medicinal methods by fusing academic research with community outreach and sustainable practices. As it expands and changes, the herbal garden is still a priceless resource for the institution and the larger community.

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Author contribution

Ms. Mittapalli Bindhupriya and Jenny Salam are pursing M.Sc. (Ag) Agronomy in the School of Agriculture, Galgotias University, Greater Noida, Uttar Pradesh. Ms. Mittapalli Bindhupriya has prepared the plant list of herbal garden and Ms. Jenny Salam took geotagged photographs of herbal garden plants. Dr. Ganesh Datt Bhatt has prepared research paper, data collection and its analysis in the School of Agriculture, Galgotias University, Greater Noida, Uttar Pradesh. Dr. Bhatt also updated reviewer's suggestions and incorporated in the research paper.

Conflict of Interest

None

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