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Floristic documentation and ethnobotanical utilization of plant diversity at the Bahadurpur site biodiversity park, Dayalbagh, Agra

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Abstract

Rehabilitation of un-arable land, conservation of phytodiversity, and optimum utilization of land are essential for the sustainable development of natural resources. Since 2017, the Department of Botany, Dayalbagh Educational Institute (DEI), Agra, has run a Rehabilitation and Conservation of Phytodiversity programme on a 9-acre (36,857 m²) experimental site near Bahadurpur village, Dayalbagh, referred to here as the Bahadurpur Site Biodiversity Park. The site serves two purposes: rehabilitation of originally un-arable land through the plantation and commercial cultivation of fruit, timber, industrial, medicinal, and aromatic plant species, supported by a dedicated Herbal Extraction Facility producing rose water, aloe vera juice, rose petal powder, rose and aloe vera face packs, rose petal jam (gulkand), and bela attar; and in-situ conservation of naturally occurring wild medicinal flora described by the Department as “the wealth of Agra,” several species of which are reported to occur only at this site and its immediate vicinity. The present paper documents the complete floristic composition of the site, integrating the Department's own planting and conservation records with a systematic field checklist, and presents genuinely cited ethnobotanical and economic utilization for the recorded taxa. In total, 160 plant taxa are documented across fruit, timber, industrial, medicinal, and aromatic cultivation blocks; a set of under-screening trial medicinal accessions; seven site-specific conserved wild medicinal species; twenty planted avenue/orchard trees with recorded population counts; a further twenty ethnomedicinally significant wild herbs; grasses; and a cultivated vegetable micro-plot expanded during a COVID-19-era planting initiative (2020-21) that also introduced *Prunus dulcis* (almond), *Pyrus communis* (pear), and *Pterocarpus santalinus* (red sandalwood), with *Ficus religiosa* established as a keystone avenue species. Reported uses are cross-validated against the published ethnobotanical literature, including the Department's own research programme on *Pedaliumpurex*, *Tribulus terrestris*, and *Andrographis paniculata*. The site is additionally used as a “lab on land” for phytodiversity and ecology teaching for M.Sc. Botany students. The findings demonstrate the value of combining commercial phytodiversity rehabilitation with in-situ wild-flora conservation on a single institutional site, and the paper recommends continued digital documentation and expansion of herbal product development at Bahadurpur.

Keywords: Phytodiversity conservation, land rehabilitation, Bahadurpur, ethnobotany, medicinal plants, Dayalbagh, herbal extraction facility

1. Introduction

Rehabilitation of un-arable land, conservation of phytodiversity, and optimum utilization of land are essential for the sustainable development of natural resources and, ultimately, for human survival on the green planet Earth. Rapid urbanization, pollution, and other anthropogenic pressures have considerably degraded terrestrial ecosystems in and around Indian cities, leading to loss of phytodiversity and of the zoo-diversity dependent upon it; several once-common plant species representing important genetic and ethnobotanical wealth have been lost from the wider landscape in recent decades. With this concern in view, a team from the Department of Botany, Dayalbagh Educational Institute (DEI), Agra, initiated a Rehabilitation and Conservation of Phytodiversity programme near Bahadurpur village, Dayalbagh, in 2017.

The experimental site, spread over approximately 9 acres (36,857 m²), has since been developed for two complementary purposes. The first is the rehabilitation of originally un-arable land through the plantation and commercial cultivation of economically

important fruit, timber, industrial, medicinal, and aromatic plant species, supported by a Herbal Extraction Facility in which undergraduate students of B.Sc. (Applied Botany Science) and B.Voc. (Agriculture Technology) learn the development of herbal products such as rose water, aloe vera juice, rose petal powder, ready-to-use rose and aloe vera face packs, rose petal jam (gulkand), and bela attar (perfume), from plants grown on site. The second is the in-situ conservation of naturally occurring wild medicinal plant species described by the Department as “the wealth of Agra” several of which are now reported to occur only at this site and its immediate vicinity, and for which local herbalists are known to visit the site to collect material. The site additionally functions as a “lab on land” in which M.Sc. Botany students study local phytodiversity and ecology.

A further, COVID-19-era (2020-21) phase of new plantation expanded the fruit, timber, industrial, medicinal, and aromatic collections at Bahadurpur, adding species such as *Prunus dulcis* (almond) and *Pyrus communis* (pear) to the orchard block, *Pterocarpus santalinus* (red sandalwood) to the medicinal collection, and *Vetiveria zizanioides* to the aromatic collection, while establishing *Ficus religiosa* as a keystone avenue species; micro-plots were also prepared for vegetable cultivation (sponge gourd, bitter gourd, bottle gourd, apple gourd/tinda, pumpkin, and lady's finger) as part of the drive for optimum land-resource utilization during a period of disrupted regular teaching activity.

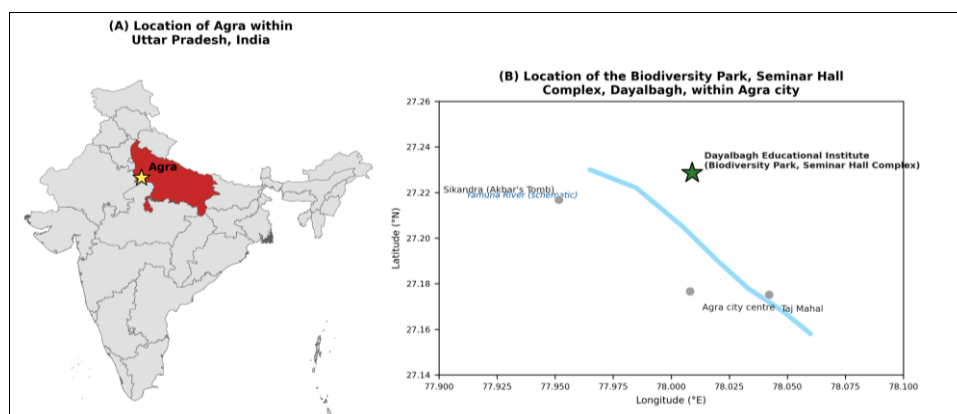
This institutional initiative builds on a long-standing departmental and individual research programme in regional ethnobotany. Earlier ethnobotanical surveys from the wider Agra region documented naturalised medicinal herbs and shrubs (Tiwari, 2016), phytochemical profiles of native herbaceous species of Agra city (Pandith, 2012)^[29], and locally important flora of another urban green space, Paliwal Park (Ojha, 2019)^[27], while related environmental studies examined Agra's pollen calendar (Chauhan, 2006), the phytoplanktonic diversity of Kitham Lake (Tiwari & Chauhan, 2005)^[9, 37, 38], invasive alien flora of the Soor Sarovar Bird Sanctuary (Wagh, 2016)^[39], and plant responses to roadside dust pollution (Rupnarayan, 2017)^[33]. An established research record in Indian ethnobotany, including documentation of Tharu tribal ethno-phytotherapeutic practices in the Terai belt of north-eastern Uttar Pradesh and across the Indo-Nepal border (Kumar, 2004; Kumar *et al.*, 2003a, 2003b; Kumar & Tewari, 2005)^[14], ethnomedicinal surveys of the Ayodhya region of Faizabad district (Kumar, Tewari, & Tripathi, 2003), and a comprehensive review of the origin, distribution, ethnobotany, and pharmacology of *Jatropha curcas* (Kumar & Tewari, 2015)^[17, 18, 19, 20], a species itself under

commercial cultivation at the Bahadurpur site. Several M.Sc. dissertations supervised at the Department have additionally evaluated the antibacterial or antifungal activity of species conserved at this very site, including *Pedaliumpurex* (Rathore, 2019), *Tribulus terrestris* (Shukla, 2018), and *Andrographis paniculata* (Bahadur, 2019)^[3, 31, 34].

Despite this substantial body of related work, the Bahadurpur site's own combined floristic composition spanning its commercial rehabilitation plantings, its conserved wild medicinal flora, and the wider spontaneous and cultivated flora recorded across the site had not previously been compiled into a single, systematically documented and genuinely cited checklist. The specific objectives of the present paper were therefore to: (i) describe the functional zonation of the Bahadurpur site and its rehabilitation and conservation design; (ii) compile a complete floristic checklist spanning the commercial (fruit, timber, industrial, medicinal, aromatic) cultivation blocks, the under-screening trial accessions, the site-specific conserved wild medicinal flora, and the wider avenue, ornamental, weed, grass, and vegetable-plot flora recorded across the site; (iii) record, where available, population counts of planted avenue and orchard trees; and (iv) compile and critically cite the ethnobotanical and economic utilization of the recorded taxa, cross-validated wherever possible against the Department's own published ethnobotanical research and site-linked dissertations.

2. Study Area

The Bahadurpur Site Biodiversity Park is located near Bahadurpur village, Dayalbagh, on the northern periphery of Agra city, Uttar Pradesh, India bounded by the Dayalbagh Poyaghat road on one side and the Seminar Hall Complex of Dayalbagh Educational Institute on the other (Figure 1). The site covers a mapped area of 36,857 m² (approximately 9 acres) and is laid out in a series of rectangular cultivation blocks separated by internal pathways radiating from a single entrance. As shown in the departmental site plan (Figure 1), the site is organised into a rehabilitation zone, comprising vegetable-cultivation plots, Aloe vera-Teak and Aloe vera-Anjeer-Teak blocks, Vetiver-Olive-Aloe vera-Kaner blocks, lemongrass blocks, a Bela (*Jasminum sambac*) garden, rose gardens, a Jamun plantation/vegetable-cultivation block, a citrus fruit orchard, a Phalsa block, a guava orchard, and a pomegranate orchard, together with a water reservoir and a net house; and a conservation zone comprising fields reserved for research and the naturally occurring wild flora they support. The two zones directly correspond to the rehabilitation and conservation functions described in Section 1.



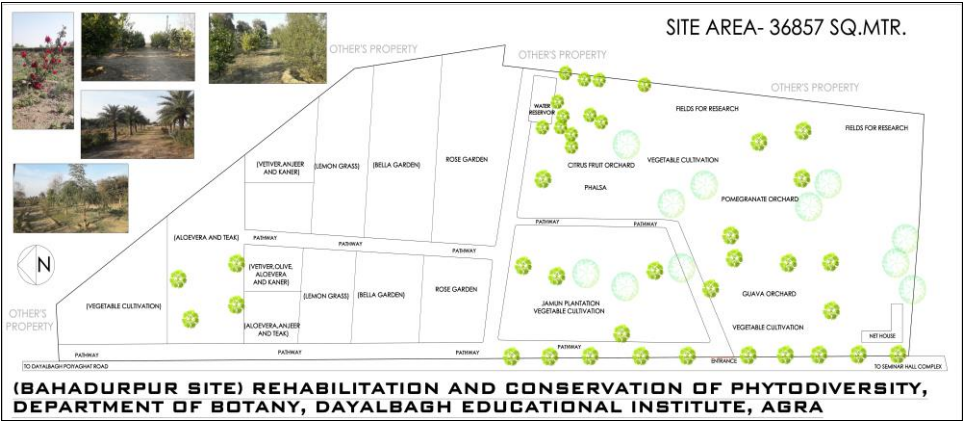


Fig 1: (A) Location of Agra within Uttar Pradesh (B) Location of Biodiversity Park Dayalbagh within Agra City (C) Departmental site plan of the Bahadurpur Site (Rehabilitation and Conservation of Phytodiversity), Department of Botany, Dayalbagh Educational Institute, Agra, showing the internal cultivation blocks, orchards, research fields, and site photographs. Site area: 36,857 m². North arrow as marked on the original plan.

3. Materials and Methods

The present documentation combines three complementary data sources. First, the Department's own planting and management records for the commercial rehabilitation blocks (fruit, timber, industrial, medicinal, and aromatic plant cultivation, and the COVID-19-era expansion plantings) were compiled, including species identity, vernacular name, and cultivation block. Second, a complete walkover floristic enumeration of the wider site was carried out, recording every planted avenue/orchard tree (with an approximate population count obtained by direct counting where feasible), spontaneously occurring (“wild”) herbaceous flora and grasses, and the cultivated vegetable micro-plots, following standard field identification against regional flora literature. Third, the site-specific conserved wild medicinal species explicitly documented by the Department as being of particular local rarity (“the wealth of Agra”) were recorded separately, together with the Department's field observation that local herbalists visit the site to collect certain of these species. Reported ethnobotanical and economic uses for all recorded taxa were then compiled and cited from the published pharmacological and ethnobotanical literature, retrieved through targeted searches of PubMed, Scopus, and Google Scholar, with priority given to the Department's own published ethnobotanical research output and to site-linked M.Sc. dissertations where directly applicable; where no specific recent primary source could be identified for a taxon (chiefly ornamental species identified only to genus level), the reported use is drawn from Khare (2007) [13], a standard peer-reviewed compendium of Indian medicinal plants.

4. Results and Discussion

4.1 Site zonation and the rehabilitation-conservation design: The Bahadurpur site's layout (Figure 1) directly embodies its dual rehabilitation-conservation mandate. Commercial cultivation blocks (orchards, medicinal and aromatic plant beds, vegetable plots) occupy the majority of the mapped area and are arranged along the internal pathway network for ease of access and irrigation from the central water reservoir, while fields explicitly reserved for research occupy the eastern margin of the site, adjoining the boundary with neighbouring properties, and support the spontaneous wild flora targeted for in-situ conservation. This spatial separation of intensively managed commercial blocks from lightly managed research/conservation fields is consistent with the Department's stated rationale of combining productive land rehabilitation with the protection of naturally occurring, locally rare medicinal flora on a single site.

4.2 Overall floristic composition: A total of 160 plant taxa are documented at the Bahadurpur site (Table 1), spanning the commercial rehabilitation blocks (fruit, timber, industrial, medicinal, and aromatic cultivation, including the COVID-19-era expansion), a set of under-screening trial medicinal accessions, seven site-specific conserved wild medicinal species, twenty planted avenue/orchard trees with recorded population counts, a further twenty wild herbaceous taxa of ethnomedicinal significance, a broader set of other planted ornamentals and structural species, wild grasses, and a cultivated vegetable micro-plot. Fabaceae, Poaceae, Asteraceae, Apocynaceae, Moraceae, and Rutaceae emerged as the most species-rich families across the site as a whole.

Table 1: Summary of the plant diversity documented at the Bahadurpur Site Biodiversity Park, by functional/growth-form category

S.No.	Category	No. of taxa	Representative taxa
1	Fruit, timber & industrial orchard block (incl. COVID-19-era additions)	17	<i>Psidium guajava</i> , <i>Citrus</i> spp., <i>Ficus carica</i> , <i>Grewia asiatica</i> , <i>Mangifera indica</i> , <i>Manilkara zapota</i> , <i>Punica granatum</i> , <i>Syzygium cumini</i> , <i>Prunus dulcis</i> , <i>Pyrus communis</i> , <i>Dalbergia sissoo</i> , <i>Tectona grandis</i> , <i>Holoptelea integrifolia</i> , <i>Jatropha curcas</i> , <i>Pongamia pinnata</i> , <i>Azadirachta indica</i> , <i>Pterocarpus santalinus</i>
2	Medicinal & aromatic plant cultivation block (incl. Herbal Extraction Facility species)	17	<i>Aegle marmelos</i> , <i>Aloe vera</i> , <i>Emblica officinalis</i> , <i>Gymnema sylvestre</i> , <i>Asparagus racemosus</i> , <i>Bryophyllum</i> sp., <i>Nyctanthes arbor-tristis</i> , <i>Moringa oleifera</i> , <i>Cymbopogon flexuosus</i> , <i>Cymbopogon winterianus</i> , <i>Jasminum sambac</i> , <i>Lawsonia inermis</i> , <i>Pandanus tectorius</i> , <i>Plumeria rubra</i> , <i>Rosa centifolia</i> , <i>Rosa damascena</i> , <i>Vetiveria zizanioides</i>

3	Under-screening trial medicinal accessions	8	<i>Bacopa monnieri</i> (Brahmi), wild turmeric, <i>Withania somnifera</i> , <i>Andrographis paniculata</i> , <i>Plantago ovata</i> , <i>Fagopyrum esculentum</i> , <i>Portulaca oleracea</i> , <i>Asparagus racemosus</i>
4	Conserved wild medicinal flora — “the wealth of Agra”	7	<i>Citrullus colocynthis</i> , <i>Tribulus terrestris</i> , <i>Pedaliu murex</i> , <i>Solanum virginianum</i> , <i>Leucas aspera</i> , <i>Trianthema monogyna</i> , <i>Boerhavia diffusa</i>
5	Planted avenue/orchard trees with recorded population counts	20	<i>Nerium</i> spp., <i>Dalbergia sissoo</i> , <i>Syzygium cumini</i> , <i>Vachellia nilotica</i> , and <i>Mangifera indica</i>
6	Other planted trees, shrubs, palms & ornamentals	~46	<i>Cassia fistula</i> , <i>Bougainvillea</i> spp., <i>Neolamarckia cadamba</i> , <i>Pithecellobium dulce</i> , <i>Cordia dichotoma</i>
7	Additional wild herbaceous flora of ethnomedicinal significance	20	<i>Achyranthes aspera</i> , <i>Eclipta prostrata</i> , <i>Calotropis procera</i> , <i>Euphorbia hirta</i> , <i>Vitex negundo</i>
8	Spontaneous wild grasses	~8	<i>Cynodon dactylon</i> , <i>Saccharum spontaneum</i> , <i>Pennisetum polystachion</i>
9	Cultivated vegetable micro-plot (incl. COVID-19-era pumpkin addition)	15	<i>Abelmoschus esculentus</i> (Lady finger), <i>Solanum lycopersicum</i> (Tomato), <i>Solanum melongena</i> (Brinjal), <i>Cucumis sativus</i> (Cucumber), <i>Cyamopsis tetragonoloba</i> (Cluster bean), <i>Cucurbita pepo</i> (Pumpkin)

4.3 Fruit, timber, and industrial orchard block

The original rehabilitation planting, begun in 2017, and its COVID-19-era (2020-21) expansion together established a diverse orchard, timber, and industrial-crop block at Bahadurpur (Table 2). Fruit species (*Psidium guajava*, *Citrus* spp., *Ficus carica*, *Grewia asiatica*, *Mangifera indica*, *Manilkara zapota*, *Punica granatum*, and *Syzygium cumini*) were supplemented during the COVID-19 phase with *Prunus dulcis* (almond) and *Pyrus communis* (pear),

extending the orchard's climatic and nutritional range. Timber species (*Dalbergia sissoo*, *Tectona grandis*, *Holoptelea integrifolia*) and industrial/oilseed-biofuel species (*Jatropha curcas*, *Pongamia pinnata*) were planted alongside *Azadirachta indica*, while *Pterocarpus santalinus* (red sandalwood), a slow-growing, high-value medicinal timber species, was introduced during the COVID-19-era expansion.

Table 2: Fruit, timber, and industrial species cultivated at the Bahadurpur site

S.No.	Botanical Name (Family)	Common Name	Category	Reported use	Reference(s)
1	<i>Psidium guajava</i> L. (Myrtaceae)	Amrood (Guava)	Fruit	Fruit consumed fresh; leaf extract confirmed antidiarrhoeal and antimicrobial	Kumar <i>et al.</i> , 2021 (Foods) ^[21]
2	<i>Citrus</i> spp. (Rutaceae)	Neebu, Kinnu	Fruit	Fruit consumed fresh/juiced; vitamin C source; peel used in folk digestive remedies	Khare, 2007 ^[13]
3	<i>Ficus carica</i> L. (Moraceae)	Anjeer (Fig)	Fruit	Fruit eaten fresh/dried; laxative and nutritive folk use	Khare, 2007 ^[13]
4	<i>Grewia asiatica</i> L. (Malvaceae/Tiliaceae)	Phalsa	Fruit	Fruit consumed fresh or as sherbet; folk antipyretic and digestive use	Khare, 2007 ^[13]
5	<i>Mangifera indica</i> L. (Anacardiaceae)	Aam (Mango)	Fruit	Major fruit crop; leaves confirmed antidiabetic and antioxidant	Kumar <i>et al.</i> , 2021 ^[22]
6	<i>Manilkara zapota</i> (L.) P. Royen (Sapotaceae)	Chiku	Fruit	Fruit consumed fresh; bark used in folk astringent remedies	Khare, 2007 ^[13]
7	<i>Punica granatum</i> L. (Lythraceae)	Anaar (Pomegranate)	Fruit	Fruit and rind widely used for antidiarrhoeal and antioxidant folk remedies	Khare, 2007 ^[13]
8	<i>Syzygium cumini</i> (L.) Skeels (Myrtaceae)	Jamun	Fruit	Seed, bark, and fruit extensively validated for antidiabetic activity	Jageti, 2023 ^[12]
9	<i>Prunus dulcis</i> (Mill.) D.A. Webb (Rosaceae)	Badam (Almond)	Fruit	Nutritive kernel; folk nervine tonic use	Khare, 2007 ^[13]
10	<i>Pyrus communis</i> L. (Rosaceae)	Nashpati (Pear)	Fruit	Fruit consumed fresh; folk digestive and diuretic use	Khare, 2007 ^[13]
11	<i>Dalbergia sissoo</i> Roxb. (Fabaceae)	Sheesham	Timber	Premier timber species; leaf extract inhibits diarrhoeal pathogen virulence	Brijesh <i>et al.</i> , 2006 ^[7]
12	<i>Tectona grandis</i> L.f. (Lamiaceae)	Sagwan (Teak)	Timber	Premier timber species; leaf/wood extracts reported in folk dye and anti-inflammatory use	Khare, 2007 ^[13]
13	<i>Holoptelea integrifolia</i> (Roxb.) Planch. (Ulmaceae)	Papdi (Chilbil)	Timber/medicinal	Bark used in folk anti-inflammatory and antidiabetic remedies	Khare, 2007
14	<i>Jatropha curcas</i> L. (Euphorbiaceae)	Jatropha	Industrial/biofuel	Seed oil for biodiesel; latex, leaf, and bark used in wound-healing and antimicrobial folk remedies	Kumar & Tewari, 2015 ^[17]
15	<i>Pongamia pinnata</i> (L.) Pierre (Fabaceae)	Kanji (Karanj)	Industrial/biofuel	Seed oil for biodiesel/lamp oil; leaf and seed used in folk dermatological remedies	Khare, 2007 ^[13]
16	<i>Azadirachta indica</i> A. Juss. (Meliaceae)	Neem	Industrial/medicinal	Broad-spectrum antimicrobial, antifungal, and antidiabetic properties (limonoids: nimbin, nimbidin)	Reddy & Neelima, 2022 ^[32]
17	<i>Pterocarpus santalinus</i> L.f. (Fabaceae)	Red sandalwood	Medicinal timber	Heartwood used in folk cooling, dermatological, and anti-inflammatory remedies	Khare, 2007 ^[13]



Fig 2: Selected orchard and fruit species under establishment at the Bahadurpur site: *Citrus* sp. (Rutaceae), *Syzygium cumini* (L.) Skeels, *Punica granatum* L., *Annona squamosa* L., and *Mangifera indica* L.

4.4 Medicinal and aromatic plant cultivation block, and the Herbal Extraction Facility

A dedicated medicinal and aromatic plant cultivation block supplies raw material to the Department's Herbal Extraction Facility, where undergraduate students of B.Sc. (Applied Botany Science) and B.Voc. (Agriculture Technology) are trained in herbal product development (Table 3). Rose petals (*Rosa centifolia* and *Rosa damascena*) are processed into rose water (gulab jal), rose petal powder, rose petal jam (gulkand), and a rose face pack; Aloe vera is processed into

juice and, in combination with rose, a face pack; and Bela (*Jasminum sambac*) flowers are distilled into bela attar (perfume). The block additionally supports *Aegle marmelos*, *Emblica officinalis*, *Gymnema sylvestre*, *Asparagus racemosus*, *Bryophyllum* sp., *Nyctanthes arbor-tristis*, and *Moringa oleifera* for medicinal use, and *Cymbopogon flexuosus*, *Cymbopogon winterianus*, *Lawsonia inermis*, *Pandanus tectorius*, *Plumeria rubra*, and (from the COVID-19-era expansion) *Vetiveria zizanioides* for aromatic/essential-oil use.

Table 3: Medicinal and aromatic species cultivated at the Bahadurpur site, including species processed at the Herbal Extraction Facility

S.No.	Botanical Name (Family)	Common Name	Reported use / product	Reference(s)
1	<i>Aegle marmelos</i> (L.) Corr. (Rutaceae)	Bel	Sacred tree; fruit validated for antidiarrhoeal and gastroprotective activity	Baliga <i>et al.</i> , 2011 ^[4]
2	<i>Aloe vera</i> (L.) Burm.f. (Asphodelaceae)	Ghratkumari	Leaf gel processed into juice and face pack; wound-healing and digestive folk use	Khare, 2007 ^[13]
3	<i>Emblica officinalis</i> Gaertn. (Phyllanthaceae)	Amla	Fruit rich in vitamin C; widely used antioxidant and immune-support Ayurvedic rasayana	Khare, 2007 ^[13]
4	<i>Gymnema sylvestre</i> (Retz.) R.Br. ex Sm. (Apocynaceae)	Gurmar	Leaf traditionally used as an antidiabetic ("sugar destroyer") remedy	Khare, 2007 ^[13]
5	<i>Asparagus racemosus</i> Willd. (Asparagaceae)	Satavar	Root used as a traditional reproductive-health and galactagogue tonic	Khare, 2007 ^[13]
6	<i>Bryophyllum</i> sp. (Crassulaceae)	Ajuba (Patharchatta)	Leaf juice used in folk treatment of renal calculi and wound care	Khare, 2007 ^[13]
7	<i>Nyctanthes arbor-tristis</i> L. (Oleaceae)	Parijat / Harsingar	Leaves and flowers used in folk antipyretic and anti-arthritic remedies	Khare, 2007 ^[13]
8	<i>Moringa oleifera</i> Lam. (Moringaceae)	Sahjan	Multipurpose nutraceutical tree; leaf extracts confirmed antidiabetic activity	Mthiyane <i>et al.</i> , 2022 ^[24]
9	<i>Cymbopogon flexuosus</i> (Nees ex Steud.) W.Watson (Poaceae)	Neembu ghas (Lemongrass)	Essential oil for lemongrass oil production; antimicrobial folk use	Khare, 2007 ^[13]
10	<i>Cymbopogon winterianus</i> Jowitt (Poaceae)	Citronella (locally, Palmarosa)	Essential oil for citronella oil; insect-repellent and antimicrobial use	Khare, 2007 ^[13]
11	<i>Jasminum sambac</i> (L.) Aiton (Oleaceae)	Bela	Flowers distilled into bela attar (perfume); folk ophthalmic and dermatological use	Khare, 2007 ^[13]
12	<i>Lawsonia inermis</i> L. (Lythraceae)	Mehandi (Henna)	Leaf paste used as a traditional dye and for dermatological/antifungal remedies	Chaudhary <i>et al.</i> , 2010 ^[8]
13	<i>Pandanus tectorius</i> Parkinson	Kewra	Flower essence (kewra water) used in perfumery and	Khare, 2007 ^[13]

	ex Du Roi (Pandanaeae)		traditional culinary/medicinal use	
14	<i>Plumeria rubra</i> L. (Apocynaceae)	Champa	Ornamental; bark and latex used in folk dermatological remedies	Khare, 2007 ^[13]
15	<i>Rosa centifolia</i> L. (Rosaceae)	Gulab (Rose)	Petals processed into rose water, rose drink, powder, face pack, and gulkand	Khare, 2007 ^[13]
16	<i>Rosa damascena</i> Mill. (Rosaceae)	Gulab (Damask rose)	Petals processed into rose water and gulkand; validated broad pharmacological profile	Boskabady <i>et al.</i> , 2011 ^[6]
17	<i>Vetiveria zizanioides</i> (L.) Nash (Poaceae)	Khas / Vetiver	Root essential oil (COVID-19-era addition); soil-binding and cooling folk use	Khare, 2007 ^[13]

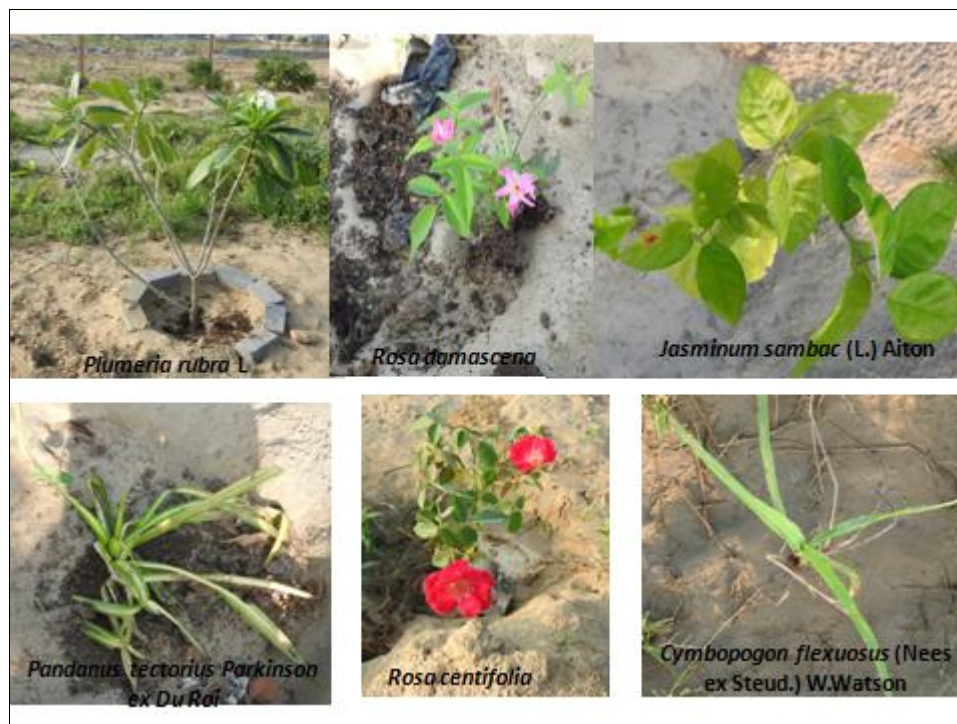


Fig 3: Aromatic and ornamental medicinal species established at the Bahadurpur site: *Plumeria rubra* L., *Rosa damascena*, *Jasminum sambac* (L.) Aiton, *Pandanus tectorius* Parkinson ex Du Roi, *Rosa centifolia*, and *Cymbopogon flexuosus* (Nees ex Steud.) W. Watson

4.5 Under-screening trial medicinal accessions

Beyond the established cultivation blocks, the Department is further screening a set of medicinally important accessions collected from various source populations for their suitability for conservation and eventual commercial cultivation at Bahadurpur (Table 4), including *Bacopa monnieri* (Brahmi), wild turmeric (collected from Solan),

Withania somnifera (Ashwagandha, collected from Agra), *Andrographis paniculata* (Kalmegh, collected from Lucknow), *Plantago ovata* (Isabgol, collected from Lucknow), *Fagopyrum esculentum* (Kuttu, collected from Pratapgarh), and *Portulaca oleracea* (Kulfa, collected from Pratapgarh), alongside further trial material of *Asparagus racemosus* (Satavar).

Table 4: Under-screening trial medicinal accessions at the Bahadurpur site

S.No.	Botanical Name (Family)	Common Name	Source of accession	Reported use	Reference(s)
1	<i>Bacopa monnieri</i> (L.) Wettst. (Plantaginaceae)	Brahmi	Field collection	Traditional nootropic/memory-enhancing tonic	Khare, 2007 ^[13]
2	<i>Curcuma</i> sp. (Zingiberaceae)	Wild turmeric	Solan	Anti-inflammatory and wound-healing folk remedy	Khare, 2007 ^[13]
3	<i>Withania somnifera</i> (L.) Dunal (Solanaceae)	Ashwagandha	Agra	Rasayana/adaptogenic tonic; broadly validated immunomodulatory activity	Khare, 2007 ^[13]
4	<i>Andrographis paniculata</i> (Burm.f.) Wall. ex Nees (Acanthaceae)	Kalmegh	Lucknow	Antipyretic, hepatoprotective, and antimicrobial folk remedy; validated protease-inhibitory activity	Panche <i>et al.</i> , 2019; Bahadur, 2019 ^[3, 28]
5	<i>Plantago ovata</i> Forssk. (Plantaginaceae)	Isabgol	Lucknow	Mucilage-rich laxative; departmentally trialled under sodic-soil cultivation conditions	Kumar <i>et al.</i> , 2019
6	<i>Fagopyrum esculentum</i> Moench (Polygonaceae)	Kuttu (Buckwheat)	Pratapgarh	Nutritive pseudocereal; folk hypotensive use	Khare, 2007 ^[13]
7	<i>Portulaca oleracea</i> L. (Portulacaceae)	Kulfa (Purslane)	Pratapgarh	Nutritive leafy vegetable; folk anti-inflammatory and diuretic use	Khare, 2007 ^[13]
8	<i>Asparagus racemosus</i> Willd. (Asparagaceae)	Satavar	Field trial	See Table 3 (reproductive-health tonic)	Khare, 2007 ^[13]

4.6 Conservation of wild medicinal flora “the wealth of Agra”

The conservation zone of the Bahadurpur site protects seven wild medicinal plant species explicitly identified by the Department as constituting part of “the wealth of Agra” (Table 5), several of which are reported to occur, in the local area, only at this site and its immediate vicinity. Local herbalists are known to visit the site specifically to collect *Pedaliu murex*, *Citrullus colocynthis*, and *Leucas aspera*.

Two of these species have been the direct subject of site-linked M.Sc. dissertation research at the Department: the antibacterial activity of *Pedaliu murex* was evaluated by Rathore (2019) ^[31], and the antifungal activity of *Tribulus terrestris* against phytopathogenic fungi was evaluated by Shukla (2018) ^[34], providing locally generated pharmacological corroboration of the traditional uses of species conserved on this exact site.

Table 5: Conserved wild medicinal flora (“the wealth of Agra”) at the Bahadurpur site

S.No.	Botanical Name (Family)	Common Name	Reported use	Reference(s)
1	<i>Citrullus colocynthis</i> (L.) Schrad. (Cucurbitaceae)	Indrayan	Fruit pulp/root traditionally used as a potent folk purgative and in dermatological remedies (toxic in excess caution)	Khare, 2007 ^[13]
2	<i>Tribulus terrestris</i> L. (Zygophyllaceae)	Bara Gokhru	Diuretic and reproductive-health folk tonic; validated antioxidant and wound-healing activity; antifungal activity confirmed at this site	Ștefănescu <i>et al.</i> , 2020; Shukla, 2018 ^[34, 36]
3	<i>Pedaliu murex</i> L. (Pedaliaceae)	Chota Gokhru	Diuretic and reproductive-health folk tonic; antibacterial activity confirmed at this site	Rathore, 2019 ^[31]
4	<i>Solanum virginianum</i> L. (Solanaceae)	Kantkari	Traditional respiratory (cough, asthma) and digestive remedy	Khare, 2007 ^[13]
5	<i>Leucas aspera</i> (Willd.) Link (Lamiaceae)	Guma	Traditional antipyretic, insecticidal, and dermatological remedy	Khare, 2007 ^[13]
6	<i>Trianthema monogyna</i> L. (Aizoaceae)	—	Folk diuretic and hepatoprotective remedy, allied to <i>T. portulacastrum</i>	Khare, 2007 ^[13]
7	<i>Boerhavia diffusa</i> L. (Nyctaginaceae)	Punarnava	Hepatoprotective, diuretic, anti-inflammatory folk remedy	Balkrishna <i>et al.</i> , 2022 ^[5]



Fig 4: Conserved wild medicinal flora at the Bahadurpur site (“the wealth of Agra”): *Tribulus terrestris* L., *Pedaliu murex* L., *Leucas aspera* L., *Solanum virginianum* L., *Citrullus colocynthis* (L.) Schrad., and *Trianthema monogyna* L.

4.7 COVID-19-era expansion and keystone-species planting

During the disrupted teaching period of the COVID-19 pandemic (2020-21), the Department used the Bahadurpur site for a further round of plantation aimed at optimum land-resource utilization. In addition to the new orchard, timber, industrial, and medicinal/aromatic species listed in Tables 2 and 3, *Ficus religiosa* (Peepal) was established as a keystone avenue species, reflecting both its ecological value

as a long-lived shade and shelter tree and its cultural and ethnomedicinal significance (bark and leaf extracts validated for antidiabetic and antimicrobial activity; Murugesu, Selamat, & Perumal, 2021) ^[25]. Micro-plots were also prepared for vegetable cultivation, adding sponge gourd, bitter gourd, bottle gourd, apple gourd (tinda), pumpkin, and lady finger to the site's existing vegetable-cultivation programme (Section 4.10), demonstrating the flexible re-purposing of the rehabilitation zone for food

production during a period of constrained campus access.

4.8 Dominant planted avenue/orchard trees with recorded population counts: Beyond the named commercial cultivation blocks, a wider field enumeration recorded twenty planted avenue and orchard tree/shrub taxa with an approximate population count (Table 6). Kaner

(*Nerium* spp., $n = 106$) and Sheesham (*Dalbergia sissoo*, $n = 74$) were the most numerous, followed by Jamun (*Syzygium cumini*, $n = 66$), Babul (*Acacia* spp., $n = 54$), and Mango (*Mangifera indica*, $n = 52$); several of these are also represented in the named commercial blocks described above (Table 2), underscoring their dual role as both avenue plantings and orchard/timber resources.

Table 6: Planted avenue/orchard tree and shrub taxa with recorded population counts at the Bahadurpur site

S.No.	Botanical Name (Family)	Common Name	Count	Reported use	Reference(s)
1	<i>Nerium</i> spp. (Apocynaceae)	Kaner	106	Ornamental; leaf/bark extracts reported in folk cardio- and dermato-therapy (toxic caution)	Khare, 2007 ^[13]
2	<i>Dalbergia sissoo</i> Roxb. (Fabaceae)	Sheesham	74	Leaf extract inhibits infectious-diarrhoea virulence mechanisms, supporting folk digestive use	Brijesh <i>et al.</i> , 2006 ^[7]
3	<i>Syzygium cumini</i> (L.) Skeels (Myrtaceae)	Jamun	66	Seed, bark, and leaf extensively validated for antidiabetic activity	Jagetia, 2023 ^[12]
4	<i>Acacia</i> spp. (Fabaceae)	Babul	54	Timber, gum, fodder; bark used in folk astringent and dental preparations	Khare, 2007 ^[13]
5	<i>Delonix</i> spp. (Fabaceae)	Gulmohar	53	Ornamental avenue tree; bark and leaf extracts reported for anti-inflammatory folk use	Khare, 2007 ^[13]
6	<i>Mangifera indica</i> L. (Anacardiaceae)	Mango	52	Leaves confirmed antidiabetic, antioxidant, and health-promoting	Kumar <i>et al.</i> , 2021 ^[21]
7	<i>Tecoma stans</i> (L.) Juss. ex Kunth (Bignoniaceae)	Yellow bells	55	Ornamental; folk antidiabetic use reported for leaf/flower extracts	Khare, 2007 ^[13]
8	<i>Psidium guajava</i> L. (Myrtaceae)	Guava	36	Leaf confirmed antidiarrhoeal and antimicrobial	Kumar <i>et al.</i> , 2021 ^[22]
9	<i>Moringa oleifera</i> Lam. (Moringaceae)	Saijan	31	Leaf extracts confirmed antidiabetic via reduced oxidative stress/inflammation	Mthiyane <i>et al.</i> , 2022 ^[24]
10	<i>Opuntia</i> spp. (Cactaceae)	Nagfani	32	Ornamental succulent; pad/fruit mucilage reported in folk wound-care use	Khare, 2007 ^[13]
11	<i>Ziziphus</i> spp. (Rhamnaceae)	Ber	30	Fruit tree; leaf and bark used in folk digestive and dermatological preparations	Khare, 2007 ^[13]
12	<i>Hibiscus rosa-sinensis</i> L. (Malvaceae)	China rose	28	Ornamental; flower extract traditionally used for hair care and as a mild laxative	Khare, 2007 ^[13]
13	<i>Ailanthus altissima</i> (Mill.) Swingle (Simaroubaceae)	Heaven tree	24	Fast-growing shade/timber tree; bark reported in folk antipyretic and anthelmintic use	Khare, 2007 ^[13]
14	<i>Aegle marmelos</i> (L.) Corr. (Rutaceae)	Belpatra	24	Fruit validated for antidiarrhoeal and gastroprotective activity	Baliga <i>et al.</i> , 2011 ^[4]
15	<i>Agave</i> spp. (Asparagaceae)	Agave/Kantala	22	Fibre plant; leaf sap traditionally applied for minor skin ailments	Khare, 2007 ^[13]
16	<i>Tectona grandis</i> L.f. (Lamiaceae)	Teak	22	Premier timber species; leaf/wood extracts in folk dye and anti-inflammatory use	Khare, 2007 ^[13]
17	<i>Casuarina equisetifolia</i> L. (Casuarinaceae)	Beefwood	13	Windbreak/timber species; bark reported for folk astringent use	Khare, 2007 ^[13]
18	<i>Morus alba/rubra</i> L. (Moraceae)	Sahtut	14	Fruit and sericulture tree; leaf used in folk antidiabetic preparations	Khare, 2007 ^[13]
19	<i>Cactus</i> spp. (Cactaceae)	Cactus	12	Ornamental succulent; mucilage used in folk topical applications	Khare, 2007 ^[13]
20	<i>Pinus gerardiana</i> Wall. ex D.Don (Pinaceae)	Pine (Chilgoza)	4	Edible-seed conifer; resin traditionally used in folk respiratory remedies	Khare, 2007 ^[13]

4.9 Additional wild herbaceous flora of ethnomedicinal significance

Beyond the seven species specifically flagged as site-defining conserved rarities (Table 5), a further twenty spontaneously occurring herbaceous taxa of established

ethnomedicinal significance were recorded across the wider site (Table 7), including *Achyranthes aspera*, *Tribulus terrestris* (also listed in Table 5), *Calotropis procera*, and *Euphorbia hirta*, each supported by dedicated recent pharmacological reviews.

Table 7: Additional wild herbaceous taxa of ethnomedicinal significance recorded at the Bahadurpur site

S.No.	Botanical Name (Family)	Common Name	Traditionally reported use	Reference(s)
1	<i>Phyllanthus niruri</i> L. (Phyllanthaceae)	Bhumi amla	Hepatoprotective; traditional treatment of jaundice and liver disorders	Balkrishna <i>et al.</i> , 2022 ^[5]
2	<i>Solanum nigrum</i> L. (Solanaceae)	Makoi	Hepatoprotective and anti-inflammatory folk use	Balkrishna <i>et al.</i> , 2022 ^[5]
3	<i>Achyranthes aspera</i> L. (Amaranthaceae)	Chirchita	Diuretic, antimicrobial, and anti-inflammatory folk remedy; validated network-pharmacology profile	Sinan <i>et al.</i> , 2020 ^[35]
4	<i>Calotropis procera</i> (Aiton)	Madar	Latex traditionally used topically for skin conditions	Pathania <i>et al.</i> , 2020 ^[30]

	Dryand. (Apocynaceae)		(caution — toxic sap)	
5	<i>Euphorbia hirta</i> L. (Euphorbiaceae)	Asthma plant	Traditional respiratory (asthma, bronchitis) and gastrointestinal remedy	Al-Mutairi <i>et al.</i> , 2019; Ali <i>et al.</i> , 2020 ^[1, 2]
6	<i>Cynodon dactylon</i> (L.) Pers. (Poaceae)	Doob	Ritual and folk haemostatic/wound-care use	Khare, 2007 ^[13]
7	<i>Eclipta prostrata</i> (L.) L. (Asteraceae)	Safed bhanga	Hepatoprotective and hair-tonic folk use; validated dermatological bioactivity	Myo <i>et al.</i> , 2023 ^[26]
8	<i>Argemone mexicana</i> L. (Papaveraceae)	Pili kateri	Folk dermatological and anthelmintic remedy (toxic sap — caution)	Khare, 2007 ^[13]
9	<i>Barleria prionitis</i> L. (Acanthaceae)	Vajradanti	Traditional dental and oral-hygiene remedy	Khare, 2007 ^[13]
10	<i>Abutilon indicum</i> (L.) Sweet (Malvaceae)	Kangi	Anti-inflammatory, antipyretic, and diuretic folk remedy	Dharuman <i>et al.</i> , 2023 ^[11]
11	<i>Plumbago zeylanica</i> L. (Plumbaginaceae)	Chitrak	Digestive-stimulant folk remedy (root)	Khare, 2007 ^[13]
12	<i>Vitex negundo</i> L. (Lamiaceae)	Nirgundi	Analgesic and anti-inflammatory folk remedy; comprehensively validated genus-wide pharmacology	Das <i>et al.</i> , 2022 ^[10]
13	<i>Cyperus rotundus</i> L. (Cyperaceae)	Motha	Digestive and antipyretic folk remedy (tuber)	Khare, 2007 ^[13]
14	<i>Sida cordifolia</i> L. (Malvaceae)	Country mallow	Anti-inflammatory folk tonic	Khare, 2007 ^[13]
15	<i>Senna occidentalis</i> (L.) Link (Fabaceae)	Kasunda	Traditional laxative and dermatological remedy	Khare, 2007 ^[13]
16	<i>Datura</i> spp. (Solanaceae)	Dhatu	Analgesic folk use (external only — highly toxic if ingested)	Khare, 2007 ^[13]
17	<i>Cannabis sativa</i> L. (Cannabaceae)	Marijuana (wild)	Historically used in folk analgesic and digestive preparations (regulated substance)	Khare, 2007 ^[13]
18	<i>Jatropha curcas</i> L. (Euphorbiaceae)	Jatropha (wild-growing individuals)	Industrial/biofuel and wound-healing use	Kumar & Tewari, 2015 ^[17]
19	<i>Cassia fistula</i> L. (Fabaceae)	Amaltas	Pod pulp used as a traditional mild laxative	Khare, 2007 ^[13]
20	<i>Tribulus terrestris</i> L. (Zygophyllaceae)	Chhota/Bara gokhru	Diuretic and reproductive-health tonic; antifungal activity confirmed at this site	Ștefănescu <i>et al.</i> , 2020; Shukla, 2018 ^[34, 36]

4.10 The cultivated vegetable micro-plot

The rehabilitation zone additionally maintains a cultivated vegetable micro-plot, expanded during the COVID-19-era plantation drive, now comprising 15 crop species: lady finger (*Abelmoschus esculentus*), bottle gourd (*Lagenaria siceraria*), sponge gourd (*Luffa aegyptiaca*), bitter melon (*Momordica charantia*), chilli (*Capsicum* spp.), cauliflower (*Brassica oleracea*), brinjal (*Solanum melongena*), peanut (*Arachis hypogaea*), round/apple gourd or tinda (*Praecitrullus fistulosus*), cluster bean (*Cyamopsis tetragonoloba*), tomato (*Solanum lycopersicum*), hyacinth bean (*Lablab purpureus*), cowpea/lobia (*Vigna unguiculata*), cucumber (*Cucumis sativus*), and, added during the COVID-19-era expansion, pumpkin (*Cucurbita moschata*). This micro-plot demonstrates the additional applied/teaching value of the site as a working model of regionally appropriate vegetable cultivation and optimum land-resource utilization.

4.11 Limitations

This documentation combines Departmental planting/management records (for the named commercial cultivation blocks) with a qualitative, photographic-voucher field enumeration (for the wider avenue, ornamental, weed, grass, and vegetable-plot flora); it is not a quantitative, plot-based vegetation survey and does not report density, cover, or yield data. Reported uses for taxa identified only to genus level in the field (e.g., *Nerium* spp., *Acacia* spp., *Ficus virens* complex, *Ipomoea* sp.) are drawn from the wider published literature on the genus, or from Khare (2007)^[13], rather than from species-specific confirmation at this exact site. The conserved wild medicinal species reported in Table

5 as occurring “only at this site and nearby areas” reflect the Department’s own field observation and have not been independently verified against a district-wide distribution survey within the scope of the present paper. Finally, the herbal products described in Section 4.4 (rose water, aloe vera juice, gulkand, bela attar, etc.) are training/teaching outputs of the Herbal Extraction Facility and are not represented here as clinically validated pharmaceutical products.

5. Conclusion

Since 2017, the Department of Botany, Dayalbagh Educational Institute, has developed the 9-acre Bahadurpur site into a dual-purpose facility combining the rehabilitation of originally un-arable land, through commercial cultivation of fruit, timber, industrial, medicinal, and aromatic plant species and a functioning Herbal Extraction Facility, with the in-situ conservation of seven wild medicinal plant species constituting “the wealth of Agra,” two of which (*Pedaliu murex* and *Tribulus terrestris*) have been independently validated for antibacterial and antifungal activity through site-linked M.Sc. dissertation research. The present paper compiles, for the first time, a complete floristic checklist of 160 plant taxa across the site’s commercial, conservation, and wider spontaneous/cultivated flora, including the COVID-19-era (2020–21) expansion that introduced almond, pear, and red sandalwood to the orchard and medicinal collections and established *Ficus religiosa* as a keystone avenue species. The Bahadurpur site thus demonstrates, at institutional scale, that productive land rehabilitation and in-situ wild-flora conservation can be pursued jointly on a single site, while simultaneously

serving as a “lab on land” for student teaching and a source of genuine, locally generated ethnopharmacological research. Continued digital documentation of the site (a living, updatable checklist and digital herbarium), further phytochemical validation of the conserved wild species, and expansion of the herbal product development pipeline are recommended as priorities for the programme going forward.

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Conflict of Interest

The authors declare that they have no conflict of interest.

References

- Al-Mutairi KA, Mobin M, Khan MN. A comparison of bioactive constituents and *in vitro* antioxidant potential of asthma weed (*Euphorbia hirta*) with those of other anti-asthmatic plants growing in Tabuk region, Saudi Arabia. *Applied Ecology and Environmental Research*. 2019;17(6):12977-12992.
- Ali MZ, Mehmood MH, Saleem M, Gilani AH. The use of *Euphorbia hirta* L. (Euphorbiaceae) in diarrhea and constipation involves calcium antagonism and cholinergic mechanisms. *BMC Complementary Medicine and Therapies*. 2020;20(1):14. DOI:10.1186/s12906-019-2793-0.
- Bahadur R. Evaluation of antibacterial activity of *Andrographis paniculata* against *Fusarium verticillioides* [M.Sc. dissertation]. Agra: Department of Botany, Dayalbagh Educational Institute; 2019.
- Baliga MS, Bhat HP, Joseph N, Fazal F. Phytochemistry and medicinal uses of the bael fruit (*Aegle marmelos* Correa): A concise review. *Food Research International*. 2011;44(7):1768-1775. DOI:10.1016/j.foodres.2011.02.008.
- Balkrishna A, Lochab S, Varshney A. Livogrit, a herbal formulation of *Boerhavia diffusa*, *Phyllanthus niruri* and *Solanum nigrum* reverses the thioacetamide induced hepatocellular toxicity in zebrafish model. *Toxicology Reports*. 2022;9:1056-1064. DOI:10.1016/j.toxrep.2022.03.053.
- Boskabady MH, Shafei MN, Saberi Z, Amini S. Pharmacological effects of *Rosa damascena*. *Iranian Journal of Basic Medical Sciences*. 2011;14(4):295-307.
- Brijesh S, Daswani PG, Tetali P, Antia NH, Birdi TJ. Studies on *Dalbergia sissoo* Roxb. leaves: Possible mechanism(s) of action in infectious diarrhoea. *Indian Journal of Pharmacology*. 2006;38(2):120-124. DOI:10.4103/0253-7613.24618.
- Chaudhary G, Goyal S, Poonia P. *Lawsonia inermis* Linnaeus: A phytopharmacological review. *International Journal of Pharmaceutical Sciences and Drug Research*. 2010;2(2):91-98.
- Chauhan SVS. Pollen calendar of Agra city with special reference to allergenic significance. *Environmental Biology*. 2006;2:275-281.
- Das N, Salgueiro ACF, Roy Choudhury D, Mandal SK, Logesh R, Hassan MM, *et al.* Traditional uses, phytochemistry, and pharmacology of genus *Vitex* (Lamiaceae). *Phytotherapy Research*. 2022;36(2):571-671. DOI:10.1002/ptr.7330.
- Dharuman A, Muthusamy P, Radha R, Rubikaa G. Review on *Abutilon indicum* An update. *International Journal of Pharmacy & Pharmaceutical Research (IJPPR.Human)*. 2023;26(4):95-113.
- Jagetia GC. Antidiabetogenic action of jamun *Syzygium cumini* Skeels: A review. *International Journal of Complementary & Alternative Medicine*. 2023;16(2):88-97. DOI:10.15406/ijcam.2023.16.00636.
- Khare CP. *Indian medicinal plants: An illustrated dictionary*. Springer; 2007.
- Kumar A. Ethnobotanical aspects of pharmacological flora used by “Tharu tribes” in Terai belt of northeastern Uttar Pradesh [Doctoral dissertation]. Faizabad: Dr. Ram Manohar Lohia Avadh University; 2004.
- Kumar A, Chaturvedy VK, Tewari SK, Tewari DD. Effect of fly ash and press mud on growth, yield and quality parameters of *Plantago ovata* cultivated in sodic soil. In: *Local Environmental Change have Global Effect*. Balrampur: MLK PG College; 2019. p. 315-331. ISBN:978-93-88838-38-2.
- Kumar A, Tewari DD. Folk botany of *Achyranthes aspera* in Terai belt of north eastern U.P. *Vegetos*. 2005;18:89-92.
- Kumar A, Tewari SK. Origin, distribution, ethnobotany and pharmacology of *Jatropha curcas*. *Research Journal of Medicinal Plant*. 2015;9:48-59. DOI:10.3923/rjmp.2015.48.59.
- Kumar A, Tewari DD, Pande YN. Ethnophytotherapeutics among Tharus of Beerpur-Semra forest range of Balrampur district (U.P.). *Journal of Economic and Taxonomic Botany*. 2003;27(4):839-844.
- Kumar A, Tewari DD, Pande YN. Indigenous and traditional herbal medicines from Gonda district of Terai belt of north eastern Uttar Pradesh. *Journal of Nature Conservation*. 2003;15(1):261-268.
- Kumar A, Tewari DD, Tripathi S. Herbal medicines from Ayodhya region of Faizabad district: An ethnophytomedicinal survey. *Journal of Living World*. 2003;10(1):26-32.
- Kumar M, Saurabh V, Tomar M, Hasan M, Changan S, Sasi M, *et al.* Mango (*Mangifera indica* L.) leaves: Nutritional composition, phytochemical profile, and health-promoting bioactivities. *Antioxidants*. 2021;10(2):299. DOI:10.3390/antiox10020299.
- Kumar M, Tomar M, Amarowicz R, Saurabh V, Nair MS, Maheshwari C, *et al.* Guava (*Psidium guajava* L.) leaves: Nutritional composition, phytochemical profile, and health-promoting bioactivities. *Foods*. 2021;10(4):752. DOI:10.3390/foods10040752.
- Lim XY, Chan JSW, Japri N, Lee JC, Tan TYC. *Carica papaya* L. leaf: A systematic scoping review on biological safety and herb-drug interactions. *Evidence-Based Complementary and Alternative Medicine*. 2021;2021:5511221. DOI:10.1155/2021/5511221.
- Mthiyane FT, Dlodla PV, Ziqubu K, Mthembu SXH, Muvhulawa N, Hlengwa N, *et al.* A review on the antidiabetic properties of *Moringa oleifera* extracts: Focusing on oxidative stress and inflammation as main therapeutic targets. *Frontiers in Pharmacology*. 2022;13:940572. DOI:10.3389/fphar.2022.940572.
- Murugesu S, Selamat J, Perumal V. Phytochemistry, pharmacological properties, and recent applications of

- Ficus benghalensis* and *Ficus religiosa*. Plants. 2021;10(12):2749. DOI:10.3390/plants10122749.
26. Myo H, Liana D, Phanumartwath A. Unlocking therapeutic potential: Comprehensive extraction, profiling, and pharmacological evaluation of bioactive compounds from *Eclipta alba* (L.) Hassk. for dermatological applications. Plants. 2023;13(1):33. DOI:10.3390/plants13010033.
27. Ojha J. Description of some important plant species at Paliwal Park. International Journal of Interdisciplinary Research. 2019;8:2348-6775.
28. Panche AN, Chandra S, Diwan AD. Multi-target β -protease inhibitors from *Andrographis paniculata*: In silico and *in vitro* studies. Plants. 2019;8:E231.
29. Pandith JI. Phytochemical screening of certain plant species of Agra city. Drug Delivery and Therapeutics. 2012;2:89-97.
30. Pathania S, Bansal P, Gupta P, Rawal RK. Genus *Calotropis*: A hub of medicinally active phytoconstituents. Current Traditional Medicine. 2020;6(4):312-327. DOI:10.2174/2215083805666190619095933.
31. Rathore R. Evaluation of antibacterial activity of *Pedaliu murex* L. [M.Sc. dissertation]. Agra: Department of Botany, Dayalbagh Educational Institute; 2019.
32. Reddy IVS, Neelima P. Neem (*Azadirachta indica*): A review on medicinal Kalpavriksha. International Journal of Economic Plants. 2022;9(1):59-63. DOI:10.23910/2/2021.0437d.
33. Rupnarayan. Responses in plants exposed to dust pollution. Horticulture International Journal. 2017;1(2):53-56.
34. Shukla S. Antifungal activity of *Tribulus terrestris* against some phytopathogenic fungi [M.Sc. dissertation]. Agra: Department of Botany, Dayalbagh Educational Institute; 2018.
35. Sinan KI, Zengin G, Zheleva-Dimitrova D, Etienne OK, Mahomoodally MF, Bouyahya A, *et al.* Qualitative phytochemical fingerprint and network pharmacology investigation of *Achyranthes aspera* Linn. extracts. Molecules. 2020;25(8):1973. DOI:10.3390/molecules25081973.
36. Ștefănescu R, Tero-Vescan A, Negroiu A, Aurică E, Vari CE. A comprehensive review of the phytochemical, pharmacological, and toxicological properties of *Tribulus terrestris* L. Biomolecules. 2020;10(5):752. DOI:10.3390/biom10050752.
37. Tiwari A. Ethnomedicinal study of some naturalized herbs and shrubs growing in Agra district in India. Biological Science. 2016;222:163-167.
38. Tiwari A, Chauhan SVS. Seasonal phytoplanktonic diversity of Kitham Lake, Agra. Environmental Biology. 2005;27(1):35-38.
39. Wagh VV. Diversity of invasive alien plants in Soor Sarovar Bird Sanctuary (SSBS), Keetham, Agra, India. International Journal of Current Research in Biosciences and Plant Biology. 2016;3:62-69.