

Angiospermic Biodiversity of Lucknow Areas of Uttar Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. Author BPS designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors AK and SCS managed the analysis of the study. Author SK managed the literature searches and performed the statistical analysis. All authors read, Improved and approved the final manuscript.

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ABSTRACT

The total angiospermic floral biodiversity of Lucknow district including indigenous, naturalised and cultigens comprises over 1263 plant species covering 705 genera and 140 families of which 989 species are dicotyledons and 274 species are monocotyledons. The monocotyledons are poorly represented except Poaceae and Cyperaceae. Of the 274 species of monocotyledons, 176 species belong to these two families while 98 species represent 23 different families. Poaceae is the largest family followed by Leguminosae (s.l.), Asteraceae, etc. and *Euphorbia* is the largest genus followed by *Cassia*, *Cyperus*, etc.

Keywords: Biodiversity; angiosperm; monocotyledons; dicotyledons; Lucknow.

1. INTRODUCTION

A comprehensive species diversity study is a prerequisite for any region to sustainably utilize the plant resources. India is one of the top twelve mega-biodiversity centers in the world because it is the meeting place for three major global biogeographic realms: the Indo-Malayan, the Eurasian and Afro-tropical and has two of the eighteen recognized biodiversity “hot-spots” in the world – the Eastern Himalaya and the Western Ghats [1-10].

The organized floristic/biodiversity study in India was first started by W. Roxburgh who published his “Flora Indica” (1833) in two volumes. This was followed by the publication of “Flora of British India” by Sir J.D. Hooker (1872-1897) in seven volumes and this gave stimulus to taxonomic studies in India. Consequently, several regional floras appeared within a short span of time. However, there was a sudden fall in floristic activities during the middle of 20th century.

The district of Lucknow formed the central part of the province of Avadh and lies between the parallels of 26°30’ and 27°10’ N latitude and 80°31’ and 81°13’ E longitude. The rain fall is about 700-800 mm annually and the temperature rises up to 46°C in the month of May and June

and falls 2°C in December and January. The district is an irregular quadrilateral with the city and cantonment of the Lucknow forming nearly the centre. It is bounded in the north by Sitapur, east by Barabanki south by Raibareli and in the north-west and the south-west, by Hardoi and Unnao districts respectively. The river Sai on the south and South-West forming the natural boundary for a short distance only. Some villages belonging to the district still lies across the river Sai to the north of the Lucknow-Kanpur road, while some villages of district Unnao lie on the Lucknow side of the river Sai.

The central upland marks the watershed and forms the most fertile part of the district. The course of the Sharda canal marks the highest level of watershed. The general slope of the district is from the north and North-West to the south and south-east with an almost imperceptible fall of one foot per mile with the exception of the immediate neighbourhood of the rivers which are entirely cut up by ravines, the slope of the land is very gradual and almost unnoticeable [11-17]. At its extreme north near Mahona the level is 450 feet above mean sea level, at Alambagh about the centre of the district near Lucknow, it is 394 feet and at Nagram on the south-east the level of 373 feet, showing a slope of not more than 43 feet in length of 45 miles, or less than 1 feet per mile.

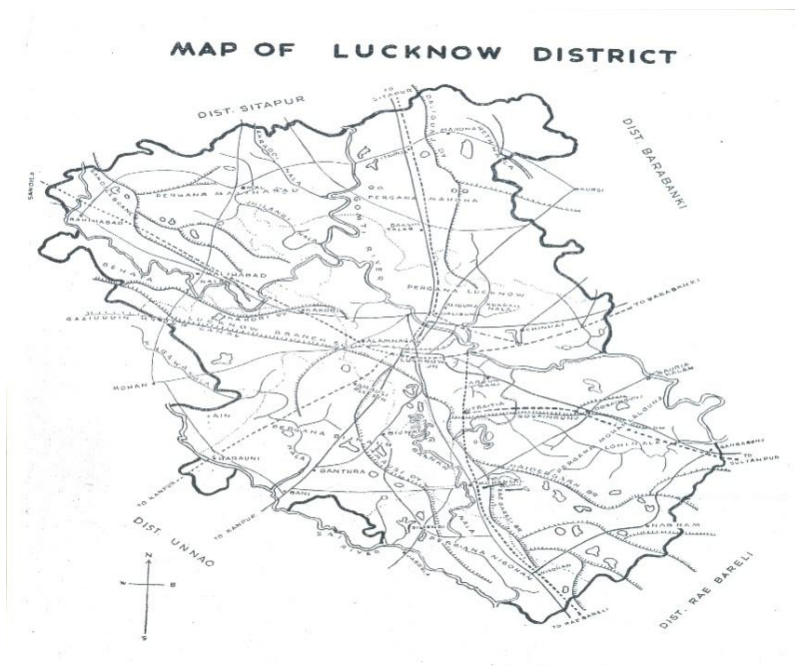


Fig. 1. Map of Lucknow district

2. METHODOLOGY

The present work is the result of intensive survey and exploration of the biodiversity of Lucknow district for the last twenty five years. In different seasons, plant specimens in flowering and fruiting stage were collected. The data on habit, habitat, abundance, associations, flowering and fruiting period, photographs of important habitats, interesting species, etc. were collected, collated and compiled. The plant specimens were collected, numbered and preserved as voucher specimens. The specimens were identified with help of monographs and regional floras. The voucher specimens are lodged in the herbarium of Central Institute of Medicinal and Aromatic Plants (Acronym: CIMAP), Lucknow.

3. RESULTS AND DISCUSSION

The total angiospermic flora of Lucknow district including indigenous, naturalised and cultigens comprises over 1263 plant species under 705 genera and 140 families, of which 989 species are dicotyledons and 274 species are monocotyledons. The monocotyledons are rather poorly represented except Poaceae and Cyperaceae. Of the 274 species of

moncotyledons, 176 species belong to these two families while 98 species represent 23 different families.

The relative importance of the families in a flora can be expressed by tabulating the first ten families in order of their number of species and comparing it with those of the adjacent regions or of the country as a whole. Smaller areas have more or less homogeneous flora as compared to larger areas.

The dominant genera in the Flora of Lucknow District is *Euphorbia* followed by *Cassia*, *Cyperus*, *Ipomoea* and so on shown in the following Table 3.

4. VEGETATIONAL DIVERSITY

The vegetational cover of Lucknow district is very poor. The percentage of the total forest area is negligible and out of it the natural forest is practically very less. Kukrail reserve forest, situated on both sides of Kukrail rivulet, Moosabagh and Rehmankherha on Hardoi road, near Chandrika Devi and near Dilkusha garden before Arjunganj crossing, etc. consist of some natural formations.

Table 1. Statistical analysis of diversity among families, genera and species

Group	Families	Genera	Species
Dicotyledons	115	560	989
Monocotyledons	25	145	274
Total	140	705	1263

Table 2. Ten dominant families of Lucknow District and its Neighbouring regions and India

Lucknow (Present study)	Delhi (Maheshwari 1963)	Gangetic (Hooker 1907)	India (Hooker 1907)
Gramineae (Poaceae)	Gramineae	Gramineae	Orchidaceae
Leguminosae(s.l.) (Fabaceae)	Leguminosae	Leguminosae	Leguminosae
Compositae (Asteraceae)	Compositae	Cyperaceae	Gramineae
Cyperaceae	Cyperaceae	Compositae	Rubiaceae
Euphorbiaceae	Acanthaceae	Scrophulariaceae	Euphorbiaceae
Acanthaceae	Euphorbiaceae	Malvaceae	Acanthaceae
Convolvulaceae	Convolvulaceae	Acanthaceae	Compositae
Scrophulariaceae	Malvaceae	Euphorbiaceae	Cyperaceae
Amaranthaceae	Amaranthaceae	Convolvulaceae	Labiatae
Verbenaceae	Scrophulariaceae	Lamiaceae	Urticaceae

Table 3. Ten dominant genera of Lucknow District

Genus	Number of species
<i>Euphorbia</i>	17
<i>Cassia</i>	15
<i>Cyperus</i>	13
<i>Ipomoea</i>	13
<i>Ficus</i>	11
<i>Eragrostis</i>	10
<i>Clerodendrum</i>	8
<i>Schoenoplectus</i>	7
<i>Digitaria</i>	7
<i>Fimbristylis</i>	7

The common tree species forming top layer are: *Acacia leucophloea* Willd., *A. nilotica* (L.) Del. ssp. *indica* (Benth.) Bren., *A. catechu* Willd., *Alangium salvifolium* (L. f.) Wang., *Albizia lebbbeck* (L.) Benth., *Azadirachta indica* A. Juss., *Bombax ceiba* L., *Butea monosperma* (Lam.) Taub., *Catunaregam spinosa* Tiev., *Dalbergia sissoo* Roxb., *Diospyros montana* Roxb., *Ficus* spp., *Flacourtia indica* Merr., *Gardenia turgida* Roxb., *Haplophragma adenophyllum* P. Dop., *Holoptelea integrifolia* (Roxb.) Planch., *Mitragyna parvifolia* Korth., *Morinda tomentosa* Heyne ex Roth, *Phoenix sylvestris* (L.) Roxb., *Pongamia pinnata* Pierre, *Prosopis juliflora* DC., *Stereospermum colais* Mabb., *Streblus asper* Lour., *Tamarindus indica* L., *Terminalia arjuna* W. et A., *T. bellirica* Roxb., *Trema orientalis* (L.) Bl., etc.

The constituents of middle layer are shrubs. Among the shrubs the notable species are *Abutilon indicum* Sweet, *Carissa spinarum* L., *Capparis sepiaria* L., *Clerodendrum multiflorum* Ktze., *C. viscosum* Vent., *Calotropis procera* R. Br., *Datura innoxia* Mill., *D. metel* L., *Jatropha glandulifera* Roxb., *J. gossypifolia* L., *Justicia adhatoda* L., *Kirganelia reticulata* (Poir.) Bail., *Lantana camara* L. var. *aculeata* (L.) Mold., *Pogostemon benghalense* Ktze., *Ziziphus nummularia* (Burm. f.) W. et A., etc.

In the lower or ground layer, there are herbs like *Setaria* spp., *Achyranthes aspera* L., *Ageratum conyzoides* L., *Ocimum americanum* L., *Indigofera linifolia* Retz., *I. linnaei* Ali, *Sida alba* L., *S. acuta* Burm. f., *S. cordata* Borss., *S. cordifolia* L., *Tephrosia purpurea* (L.) Pers., *Uria picta* (Jacq.) Desv. ... and many other sedges and grasses like ... *Cyperus* spp., *Fimbristylis* spp., *Schoenoplectus* spp., *Scirpus* spp., *Cynodon dactylon* Pers., *Brachiaria* spp., *Eragrostis* spp., *Digitaria* spp., *Panicum* spp., *Setaria* spp. etc.

Among the twiners and climbers, some of the species are *Abrus precatorius* L., *Ampelocissus latifolia* Planch., *Bryonopsis laciniata* Naud., *Capparis zeylanica* L., *Cayratia trifolia* Domin, *Celastrus paniculatus* Willd., *Ceropegia longifolia* Wall., *Coccinia grandis* Voigt., *Cocculus hirsutus* (L.) Diels., *Cryptolepis buechanani* R.Br. ex R.&S., *Hemidesmus indicus* R.Br., *Ichnocarpus frutescens* Ait. et Ait., *Ipomoea* spp. *Leptadenia reticulata* W. et A., *Momordica dioica* Roxb. ex Willd., *Melothria maderaspatana* Cong., *Telosma pallid* Spreng., *Tinospora cordifolia* (Willd.) Miers., *Ventilago denticulata* Willd. and *Ziziphus oenoplia* Mill.

The common parasites on the forest trees are *Cuscuta reflexa* Roxb. and *Dendrophthoe falcata* (L.f.) Ettings.

The noteworthy medicinal plants are *brus precatorius* L., *Acacia* spp., *Achyranthes aspera* L., *Albizia lebbbeck* Benth., *Andrographis paniculata* Nees ex Wall., *Bacopa monnieri* Wettst., *Baliospermum montanum* Muell.-Arg., *Butea monosperma* (Lam.) Taub., *Calotropis* spp., *Cassia* spp., *Catharanthus roseus* G. Don, *Celastrus paniculatus* Willd., *Centella asiatica* (L.) Urban, *Cissampelos pareira* L., *Datura innoxia* Mill., *Gloriosa superba* L., *Justicia adhatoda* L., *Hemidesmus indicus* R. Br., *Holarrhena pubescens* Wall. ex G. Don, *Leucas* spp., *Phyllanthus* spp., *Plumbago zeylanica* L., *Rauvolfia serpentina* Benth. ex Kurz, *R. tetraphylla* L., *Sida* spp., *Solanum nigrum* L., *S. virginianum* L., *Streblus asper* Lour., *Terminalia* spp., *Tinospora cordifolia* Miers. and *Withania somnifera* (L.) Dunal.

4.1 Seasonal Vegetation/Diversity

The seasonal variation of climatic factors is so great that the herbaceous species can, only with difficulty, remain dominant throughout the year.

The common species diversity during different seasons are mentioned below:

The species of rainy season are represented by *Acalypha indica* L., *Alysicarpus* spp., *Amischophacelus axillaris* (L.) Rao et Kam., *Apluda mutica* L., *Boerhavia diffusa* L., *Brachiaria ramosa* Stapf, *B. reptans* Gard., *Cayratia trifolia* Domin, *Catharanthus pusillus* G. Don, *Cleome gynandra* L., *C. viscosa* L., *Coccinia grandis* Voigt, *Commelina benghalensis* L., *Cocculus hirsutus* Diels, *Corchorus aestuans* L., *C. capsularis* L., *C. olitorius* L., *Crotalaria medicaginea* Lamk., *Cyperus* spp., *Dactyloctenium aegyptium* Beauv., *Desmodium gangeticum* DC., *D. triflorum* DC., *Desmostachya bipinnata* Stapf, *Digera muricata* Mart., *Eragrostis tenella* R. & S., *E. tremula* Hochst., *E. poaeoides* Beauv., *Euphorbia hirta* L., *Hybanthus enneaspermus* Muell., *Hygrophila auriculata* Heyne, *Indigofera linifolia* Retz., *I. linnaei* Ali, *Ipomoea pes-tigridis* L., *Justicia quinqueangularis* Koen. ex Roxb., *J. simplex* D. Don, *Leucas aspera* Spreng., *L. cephalotes* Spreng., *Lindernia ciliata* Pennell, *Malvastrum coromandelianum* Garcke, *Martynia annua* L., *Melochia corchorifolia* L., *Momordica charantia* L., *M. dioica* Roxb., *Murdannia nudiflora* Brenan, *Oplismenus burmannii* Beauv., *Phyllanthus amarus* Schum. et Thonn., *P. fraternus* Webst., *Physalis minima* L., *Sida* spp., *Tephrosia purpurea* Pers., *Trianthema portulacastrum* L., *Triumfetta rhomboidea* Jacq., *Urena lobata* L., *Xanthium indicum* L., and *Zornia gibbosa* Span.

The vegetation of rainy season disappears in October with the same rapidity as it came rainfalls. As the cold starts, temperature becomes low and atmosphere becomes dry, the species of the higher altitudes, elevated regions or of European genera make their appearance and begin dominating throughout. Some of the typical winter species worth mentioning are *geratum conyzoides* L., *Antirrhinum orontium* L., *Blumea* spp., *Breca arvensis* Less., *Bryonopsis laciniosa* Naud., *Coronopus didymus* Sm., *Echinops echinatus* Roxb., *Fumaria indica* Pugsley, *Glinus lotoides* L., *Gnaphalium indicum* L., *G. pulvinatum* Dilile, *G. purpureum* L., *Launaea aspleniifolia* Hk. f., *Medicago lupulina* L., *M. polymorpha* L., *Melilotus alba* Desr., *M. indica* All., *Oxalis corniculata* L., *Poa annua* L., *Polygonum plebeium* R. Br., *Potentilla supina* L., *Ranunculus sceleratus* L., *Rumex dentatus* L., *Rungia pectinata* Nees, *Salvia plebeia* R.Br., *Solanum nigrum* L., *Sonchus brachyotus* DC., *S. asper* Hill., *S. oleraceus* L., *Spergula fallax*

Krause, Staurogyne glutinosa Ktze., *Stellaria media* Vill., *Verbascum chinense* Santap., *Veronica anagallis-aquatica* L., *Vicia hirsuta* Gray, *V. sativa* L.

As the weather warms up in March, the seeds that lie dormant now germinate and show various xerophytic features. The common species associated with summer season are *Iternanthera paronychioides* St. Hill, *A. pungens* H.B.K., *A. sessilis* DC., *Amaranthus* spp., *Arnebia hispidissima* DC., *Blepharis maderaspatensis* Heyne ex Roth., *Calotropis procera* R. Br., *Chrozophora rottleri* Juss., *Convolvulus microphyllus* Sieb., *Euphorbia dracunculoides* Lamk., *Evolvulus nummularius* L., *Glinus lotoides* L., *Gomphrena celosioides* Mart., *Heliotropium ellipticum* Ladeb., *H. indicum* L., *H. strigosum* Willd., *Hemigraphis hirta* T. Anders., *Imperata cylindrica* (L.) Beauv., *Phyla nodiflora* Greene, *Pluchea lanceolata* Cl., *Solanum virginianum* L., *Trichodesma sedgwickianum* Ban., *Withania somnifera* (L.) Dunal, etc.

5. DIVERSITY OF SPECIAL HABITAT

5.1 Aquatic and Marshland Diversity/Vegetation

The common habitat of aquatic and marshland vegetation are rivers, lakes, ponds, puddles, ditches and low lying areas which remain submerged during major part of the years. The hydrophytes of Lucknow can be classified into following six categories on the basis of their contact with air, water and soil:

- i) **Free-floating:** In this category the species are only in contact with air and water like *Eichhornia crassipes* Solms., *Hygroryza aristata* Nees, *Pistia stratiotes* L., *Spirodela polyrrhiza* Schleid, *Trapa bispinosa* Roxb., *Wolffia arrhiza* Wimm., etc.
- ii) **Suspended:** In this group the species are only in contact with water and are rootless, e.g. *Ceratophyllum demersum* L., *Utricularia stellaris* var. *inflexa* Cl., *U. flexuosa* Vahl, etc.
- iii) **Submerged attached:** These are only in contact with soil and water but in some cases flowers are slightly raised above water, e.g. *Hydrilla verticillata* Royle, *Ottelia alismoides* Pers., *Potamogeton crispus* L., *P. nodosus* Poir., *P. pectinatus* L., *Vallisneria spiralis* L., etc.
- iv) **Attached with floating leaves:** These are in contact with water, soil as well as air,

e.g. *Aponogeton crispus* Thunb., *Ipomoea aquatica* Forsk., *Ludwigia adscendens* Hara, *Nelumbo nucifera* Gaertn., *Nymphaea nouchali* Burm. f., *N. stellata* Willd., *Nymphoides indicum* Ktze., *N. hydrophyllum* Ktze., etc.

- v) **Amphibious:** In this case the root, lower part of the stem and in some cases lower leaves are usually submerged in water, e.g. *Aeschynomene aspera* L., *Amischophacelus axillaris* R. Rao et Kam., *Eleocharis dulcis* Hen., *Hemarthria compressa* R. Br., *Ischaemum rugosum* Salisb., *Polygonum* ssp., *Limnophyton obtusifolium* (L.) Miq., *Sagittaria guayanensis* H.B.K., *S. sagittifolia* L., etc.
- vi) **Wetland:** A large number of species represent this group e.g. *Alternanthera paronychioides* St' Hill., *A. sessilis* DC., *A. pungens*, *Bacopa monnieri* (L.) Pennell, *Caesulia axillaris* Roxb., *Centella asiatica* L., *Cyperus* spp., *Dentella repens* Forsk., *Eclipta prostrata* L., *Fimbristylis* spp., *Hygrophila auriculata* Heyne, *Limnophila indica* Druce, *Polygonum plebeium* R.Br., *Scirpus* spp., *Sphenoclea zeylanica* Gaertn., *Typha angustata* Bory et Chaub., *Veronica anagallis-aquatica* L., etc.

5.2 Diversity along Banks of Rivers, Lakes and Nallas

The species frequently met along the banks of rivers, ditches, ponds, lakes and nallas (Fig) are *Alternanthera paronychioides* St., Hill, *Argemone mexicana* L., *A. ochroleuca* Sweet, *Arundo donax* L., *Chenopodium ambrosioides* L., *Chrozophora rotleri* Juss., *Coronopus didymus* Sm., *Croton bonplandianum* Baill., *Cyperus* ssp., *Fimbristylis bisumbellata* Bub., *Lippia javanica* Spreng., *Nicotiana plumbaginifolia* Viv., *Phragmites karka* Blatt., *Phyla nodiflora* Greene, *Polygonum plebeium* R.Br., *Pulicaria crispa* Sch.-Bip., *Ranunculus sceleratus* L., *Rumex dentatus* L., *R. nepalensis* Spreng., *Sesbania sesban* Merr., *Tamarix dioica* Roxb., *Typha angustata* Bory et Chaub., *Verbascum chinense* (L.) Sant., *Xanthium indicum* L., etc.

5.3 Species Diversity of Old Buildings, Walls, and Rocky Crevices

The species growing in these peculiar habitats are presumably lime loving and therefore find the crevices in brick-walls, subsurface of plaster coverings and rocky crevices as a favourable habitat. The species in these habitats are

Boerhavia diffusa L., *Cassia tora* L., *Chenopodium album* L., *Cleome viscosa* L., *Commelina benghalensis* L., *Corchorus aestuans* L., *Cyperus* spp., *Eleusine indica* Gaertn., *Eragrostis tenella* (L.) Beauv., *Ficus benghalensis* L., *F. religiosa* L., *Lindenbergia macrostachya* Benth., *L. muraria* P. Bruehl, *Malvastrum coromandelianum* (L.) Garcke, *Peperomia pallucida* H.B.K., *Peristrophe paniculata* Broom., *Phyllanthus amarus* Schum. et Thonn., *P. fraternus* Webst., *Physalis minima* L., *Polypogon monspeliensis* Desf., *Portulaca pilosa* L., *Rungia pectinata* Nees, *Solanum nigrum* L., *Trianthema portulacastrum* L., *Tridax procumbens* L., etc.

5.4 Diversity of Tree Species along Roadsides

Much of the greenery of the area is provided by a number of avenues, ornamental and economically important trees planted along roadsides. The common ones are *Acacia auriculaeformis* A. Cunn., *Ailanthus excelsa* Roxb., *Albizia lebbek* Benth., *Azadirachta indica* Juss., *Cassia fistula* L., *C. siamea* Lamk., *C. surattensis* Burm. f., *Delonix regia* Raf., *Dalbergia sissoo* Roxb., *Drypetes roxburghii* (Wall.) Hurusawa, *Eucalyptus* spp., *Ficus benghalensis* L., *F. virens* Ait., *F. racemosa* L., *F. religiosa* L., *Grevillea robusta* A. Cunn., *Holoptelea integrifolia* Planch., *Kigelia pinnata* DC., *Lagerstroemia speciosa* Pers., *Madhuca indica* Gmel., *Peltophorum pterocarpum* Bak., *Polyalthia longifolia* Thw., *Pithecellobium dulce* (Roth) Benth., *Pongamia pinnata* Pierre, *Pterospermum acerifolium* Willd., *Prosopis juliflora* DC., *Syzygium cumini* (L.) Skeels, *S. jambos* (L.) Alst., *Tamarindus indica* L., *Terminalia arjuna* W. et A., *T. bellirica* Roxb., etc.

5.5 Diversity of Species along Roadsides, Waste Places and Railway Tracks

These habitats are disturbed from time to time and are very much susceptible to invasion of a weed flora which quickly occupies such areas. Some of the worth mentioning weeds are: *Ageratum conyzoides* L., *Argemone mexicana* L., *A. ochroleuca* Sweet., *Blumea* spp., *Boerhavia diffusa* L., *Cannabis sativa* L., *Carissa spinarum* L., *Capparis sepiaria* L., *Clerodendrum multiflorum* Ktze., *Cassia alata* L., *C. obtusifolia* L., *C. occidentalis* L., *C. tora* L., *Cleome gynandra* L., *C. viscosa* L., *Calotropis procera* R.Br., *Croton bonplandianum* Baill., *Crotalaria medicaginea* Lamk., *Datura metel* L., *D. innoxia*

Mill., *Justicia adhatoda* L., *Launaea aspleniifolia* L., *Malvastrum coromandelianum* (L.) Garcke, *Parthenium hysterophorus* L., *Saccharum spontaneum* L., *S. benghalense* Retz., *Sida acuta* Burm. f., *S. cordifolia* L., *S. rhombifolia* L., *Euphorbia hirta* L., *E. thymifolia* L., *Tephrosia purpurea* (L.) Pers., *Xanthium indicum* L. and many sedges and grasses.

5.6 Species Diversity of Cultivated Fields

A number of weeds are associated with crop plants. The common ones associated with Kharif are: *Aeschynomene indica* L., *Alysicarpus bupleurifolius* (L.) DC., *A. vaginalis* (L.) DC., *Borreria articularis* F.N. Will., *Bulbostylis barbata* Cl., *Cleome gynandra* L., *C. viscosa* L., *Cyperus* spp., *Corchorus aestuans* L. *C. olitorius* L., *C. capsularis* L., *Digera muricata* Mart., *Eleusine indica* Gaertn., *Echinochloa colona* Link., *E. crusgalli* Beauv., *Eragrostis* spp., *Leucas aspera* Spreng., *L. cephalotes* Spreng., *Limnophila indica* (L.) Druce, *Phyllanthus amarus* Schum. et Thonn., *P. fraternus* Webst., *P. virgatus* Forst. f., *Rotala indica* Koehne etc. Rabi crop also consists of some common weeds like *Ageratum tenuifolius* L., *Anagallis arvensis* L., *Asphodelus tenuifolius* Cav., *Argemone mexicana* L., *A. ochroleuca* Sweet, *Chenopodium album* L., *C. murale* L., *Breea arvensis* Less., *Euphorbia dracunculoides* Lam., *Fumaria indica* Pugsley, *Gnaphalium purpureum* L., *Medicago lupulina* L., *M. polymorpha* Pers., *Melilotus alba* Desr., *M. indica* All., *Phalaris minor* Retz., *Vicia hirsuta* Gray, *V. sativa* L., etc.

5.7 Endangered and Threatened Species

Due to various biotic as well as abiotic factors many of the species of the district are depleting day by day. Some of the important ones are: *Abrus precatorius* L., *Alhagi maurorum* Medik., *Andrographis paniculata* Nees ex Wall., *Baliospermum montanum* Muell.-Arg., *Biophytum sensitivum* DC., *Cassia absus* L., *Cassia pumila* Lam., *Catunaregam spinosa* Tiev., *Celastrus paniculatus* Willd., *Costus speciosus* Smith, *Cryptolepis buchanani* R.&S., *Curculigo orchoides* Gaertn., *Curcuma angustifolia* Roxb., *Dentella serpyllifolia* Wall. ex Craib, *Gloriosa superba* L., *Hibiscus lobatus* Ktze., *Holarrhena pubescens* Wall. ex G. Don, *Ipomoea nil* Roth, *Ipomoea turbinata* Lag., *Helicteres isora* L., *Hemidesmus indicus* R.Br., *Holarrhena pubescens* Wall. ex G. Don, *Leptadenia reticulata* W. & A., *Malva parviflora* L., *Marsdenia tenacissima* Moon, *Milium velutina* Hk. f. et

Thom., *Mucuna pruriens* DC., *Oenanthe javanica* DC., *Orthosiphon pallidus* Royle ex Benth., *Oxystelma esculentum* R. Br., *Phyllanthus maderaspatensis* L., *Plumbago zeylanica* L., *Rauvolfia serpentina* Benth. ex Kurz, *Salvadora persica* L., *Schleichera oleosa* Oken, *Schoenoplectus grossus* Palla, *Utraria picta* Desv. ex DC., *Ventilago denticulata* Willd., *Verbascum thapsus* L., *Verbena officinalis* L., *Zeuxine strateumatica* Schltr.

5.8 Ornamental Species

A large number of trees, shrubs, annuals, pot herbs, climbers, twiners, are frequently grown as ornamentals in gardens, parks, public places, house yards and in hedges. The common among them are: *Acacia auriculiformis* Cunn., *Aglaonema* spp., *Alcea rosea* L., *Allamanda cathartica* L., *Alocasia* spp., *Anthocephalus chinensis* A. Rich. ex Walp., *Anthurium* spp., *Artabotrys hexapetalus* Bhandari, *Agathis* sp., *Bauhinia* spp., *Beloperone* sp., *Bignonia alliacea* Lam., *B. unguis-cati* L., *Bougainvillea* spp., *Buddleja* spp., *Caesalpinia pulcherrima* Swartz., *Caladium* spp., *Calliandra* spp., *Callistemon* spp., *Campsis grandiflora* Schum., *C. radicans* (L.) Seem. ex Bureau, *Caryota urens* L., *Cassia alata* L., *C. auriculata* L., *C. roxburghii* DC., *C. siamea* Lam., *C. surattensis* Burm. f., *Centaurea* spp., *Cereus* spp., *Christia vespertilionis*(L.) Bakh. f., *Clerodendrum splendens* G. Don, *Clitoria ternatea* L., *Coleus blumei* Benth., *Crossandra* sp., *Cycas* spp., *Delonix regia* Raf., *Dieffenbachya* spp., *Duranta repens* L., *Erythrina cristgalli* L., *E. variegata* L., *Euphorbia milli* Ch. des Moul., *E. neriifolia* L., *E. nivulia* Buch.-Ham., *E. tirucalli* L., *Ficus benjamina* King., *Galphimia gracilis* Bartl., *Gardenia jasminoides* Ellis, *G. latifolia* Soland., *Gmelina philippensis* Cham., *Gomphrena globosa* L., *Grevillea robusta* Cunn. ex R.Br., *Hamelia patens* Jacq., *Heliconia* sp., *Hibiscus rosa-sinensis* L., *H. schizopetalus* Hk. f., *Iberis amara* L., *Ipomoea quamoclit* L., *Ixora* spp., *Jacaranda mimosifolia* D. Don, *Jasminum* spp., *Jatropha integerrima* Jacq., *Justicia gendarussa* Burm. f., *Koelreuteria apiculata* Rehd. & Wilson, *Lagerstroemia indica* L., *L. reginae* Roxb., *L. tomentosa* Presl, *Lobularia* spp., *Lupinus* spp., *Malpighia glabra* L., *Malvaviscus arboreus* Cav., *Millingtonia hortensis* L. f., *Monstera* sp., *Mussaenda frondosa* L., *Nerium indicum* Mill., *Nyctanthes arbor-tristis* L., *Parkinsonia aculeata* L., *Pedilanthus tithymaloides* Poir., *Petrea volubilis* L., *Petunia* spp., *Pinus roxburghii* Sarg., *Plumeria* spp., *Punica granatum* L., *Pyrostegia venusta*

Miers, *Quisqualis indica* L., *Ravanella madagascariensis* J.F. Gmel., *Ravenia spectabilis* Griseb., *Rheo spathacea* Stern., *Roystonea regia* Cook., *Saraca asoca* De Willde, *Setcreasea pallida* Rosc., *Scindapsus* spp., *Spathodea campanulata* Beauv., *Tabebuia* spp., *Tecoma stans* H.B.K., *Thunbergia* spp., *Verbena* spp., *Wedelia urticaefolia*, *Zebrina pendula* Sch., etc.

6. ECONOMICALLY IMPORTANT SPECIES

The information on the vegetation and flora of a region is incomplete without a list of economically important plants. Hence, the following list is given:

Cereals: The notable cereals cultivated throughout the district are: *Avena sterilis* L. var. *culta* Raizada, *Hordeum vulgare* L., *Oryza sativa* L., *Pennisetum* spp. *Setaria italica* (L.) P. Beauv., *Sorghum vulgare* (L.) Pers., *Zea mays* L., etc.

Pulses: The commonly cultivated pulses are: *Cajanus cajan* (L.) Millsp., *Cicer arietinum* L., *Lens culinaris* Medik., *Pisum sativum* L., *Vigna mungo* Hepper, *V. radiata* (L.) Wilczek, etc.

Vegetables: The common vegetables grown in the district are: *Abelmoschus esculentus* (L.) Moench., *Allium cepa* L., *Amorphophalus campanulatus* Bl., *Beta vulgaris* L., *Coccinia grandis* (L.) Voigt, *Colocasia esculenta* (L.) Schott., *Cucurbita maxima* Duch., *Cucumis sativus* L., *Cyamopsis tetragonoloba* (L.) Taub., *Daucus carota* L., *Labiab purpureus* Sw., *Lagenaria siceraria* Standley, *Luffa acutangula* Roxb., *L. cylindrica* (L.) Roem., *Lycopersicon esculentum* Mill., *Momordica charantia* L., *Raphanus sativus* L., *Solanum melongena* L., *S. tuberosum* L., *Spinacia oleracea* L., *Trichosanthes dioica* Roxb., etc.

Fruits: The notable edible fruits of the district are: *Annona squamosa* L., *Averrhoa carambola* L., *Carica papaya* L., *Cucumis melo* L., *Grewia subinaequalis* DC., *Mangifera indica* L., *Manilkara hexandra* (Roxb.) Dub., *Morus* spp., *Musa paradisiaca* L., *Physalis peruviana* L., *Psidium guajava* L., *Vitis vinifera* L., *Ziziphus mauritiana* Lam., etc.

Timbers: The common timber trees of the district are: *Acacia nilotica* (L.) Del. ssp. *indica* Brenan, *Bambusa* spp., *Dalbergia sissoo* Roxb.,

Dendrocalamus strictus Nees, *Eucalyptus* spp., *Haplophragma adenophyllum* P. Dop., *Madhuca indica* Gmel., *Tectona grandis* L.f., etc.

Oil yielding plants: The common oil yielding plants are: *Arachis hypogaea* L., *Brassica* spp., *Linum usitatissimum* L., *Sesamum indicum* L., etc.

Fodder plants: *Crotalaria juncea* L., *Pennisetum* spp., *Sorghum vulgare* (L.) Pers., *Trifolium alexandrianum* L., etc. are cultivated to meet the requirement of fodder.

Fibre yielding plants: *Crotalaria juncea* L., *Gossypium* spp., *Hibiscus cannabinus* L. are chiefly grown.

Spices and condiments: The common spices and condiments cultivated are: *Allium sativum* L., *Capsicum annuum* L., *Coriandrum sativum* L., *Cuminum cyminum* L., *Foeniculum vulgare* Mill., *Nigella sativa* L., *Trachyspermum ammi* (L.) Sprague, *Trigonella foenum-graecum* L., etc.

7. CONCLUSION

The total angiospermic floral biodiversity of Lucknow district including indigenous, naturalised and cultigens comprises over 1263 plant species covering 705 genera and 140 families, of which 989 species are dicotyledons and 274 species are monocotyledons.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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