

**THREATENED ANGIOSPERMS OF THE INDO-GANGETIC PLAINS: A CASE STUDY
OF UTTAR PRADESH**Pallavi Sharma¹ and Tulika Mishra*¹Research Scholar, *Assistant Professor, Department of Botany, Deen Dayal Upadhyaya Gorakhpur University,
Gorakhpur, Uttar Pradesh-273309.

*Corresponding Author: Tulika Mishra

Assistant Professor, Department of Botany, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur, Uttar Pradesh-273309.

Article Received on 05/03/2025

Article Revised on 26/03/2025

Article Accepted on 15/04/2025

ABSTRACT

Biodiversity helps in maintaining ecological balance. In addition, it offers protection against environmental disasters like droughts and floods. There has been a lot of degradation of nature due to anthropogenic activities. Due to the exploitation of nature, many animals, birds, and trees are on the verge of extinction. In Uttar Pradesh, the total forest area constitutes about 6.88% of its total geographical area. Many threatened and endemic angiosperms inhabit here. The plant family Balsaminaceae has the highest number of endangered plant species in Uttar Pradesh. Maximum members of the Poaceae family are endemic to angiosperm. Scientists, researchers, and the government need to pay attention to the flora of Uttar Pradesh. Tissue culture is an effective way to conserve threatened species.

KEYWORDS: Uttar Pradesh, Endangered, Endemic, Conservation, Terai region.**INTRODUCTION**

Global biodiversity is continuously depleting and many species of animals and plants are rapidly becoming extinct or endangered due to the uncontrolled exploitation of natural resources and selfish activities of man. Biodiversity includes all types of organisms located on Earth, including terrestrial, marine, and aquatic ecosystems. It includes diversity at three levels: genetic diversity (within species), species diversity (between species), and ecological diversity (between ecosystems). Biodiversity is essential for the survival and well-being of mankind. It is the core of all developmental activities as it provides food, fodder, medicines, water, clean air, and other materials and services. Conservation biology is the scientific study of nature and the levels of Earth's biodiversity to protect species, their natural habitats, and ecosystems from extinction. The term "Conservation Biology" was introduced as a title by biologists Bruce Wilcox and Michael Soule at a 1978 conference at the University of California, La Jolla, Calif. The meeting arose out of concern among scientists over tropical deforestation, endangered species, and damaged genetic diversity within species. The resulting conferences and proceedings sought to bridge the gap between ecological theory and fauna-community biology on the one hand, and conservation policy and practice on the other (Tilman *et al.*, 2006).

Uttar Pradesh is a beautiful state of India, which is located in North India. Uttar Pradesh is surrounded by 9 other states of India. It is divided into 18 divisions and 75 districts; the state of Uttar Pradesh is known for its attractive tourist destinations as well as natural beauty and various wildlife species. Uttar Pradesh serves as a haven for rich flora and some important wildlife species of India, and for this purpose, various wildlife reserves have been established in different regions of the state and these wildlife reserves are an important part of Uttar Pradesh tourism. It is the fourth largest and highest population density state in the country (area-wise). According to Uttar Pradesh State Biodiversity Board (2022), on 3.7 percent of the total area of the country, Uttar Pradesh sustains 16.49 percent of the human population and about 12 percent of the livestock population. The density of population in the state is 828 persons per square kilometer. Agriculture is the main occupation of the people. Sufficient water flow is available in the state through many rivers like Ganga, Yamuna, Ramganga, Gomti, Ghaghara, Gandak, Chambal, Betwa, Ken, Son etc. Here the total forest or tree cover is spread over an area of 21,720 sq. km, which is 9.01 percent of the single geographical area of the state. There is a National Forest Park and 24 Wildlife Sanctuaries in the state. Uttar Pradesh has the greatest number of Ramsar Sites in India. It has 10 Indian Wetlands. The latest data from the Remote Sensing Application Center shows that Uttar Pradesh has an area

of 11,45,178 hectares of wetlands (4.8 percent of the total geographical area). About 2881 species of plants are recorded in Uttar Pradesh, which is 6.34 percent of the total species in India. The National Bureau of Fish Genetic Resources has recorded about 115 species of fish from 20 rivers in Uttar Pradesh. Out of these 109 are indigenous fishes and 06 are foreign fishes.

Geography of Uttar Pradesh

Uttar Pradesh is bounded by Uttarakhand and Himachal Pradesh in the north-west, Haryana and Delhi in the west, Rajasthan in the south-west, Madhya Pradesh in the south, Chhattisgarh and Jharkhand in the south-east and Bihar in the east. Situated between 23°52'N and 31°28'N latitudes and 77°3' and 84°39'E longitudes, it is the country's fourth-largest in terms of area and the first state in terms of population. Uttar Pradesh can be divided into three distinct hypothesis zones.

1. Shivalik foothills and Terai in the north

2. Gangetic plain in the centre – highly fertile alluvial soil; flat topography broken by numerous ponds, lakes, and rivers; slope 2m/km.
3. Vindhya Hills and plateau to the south – hard rock strata; varied topography of hills, plains, valleys, and plateaus; Limited water availability.

In Uttar Pradesh, the total forest area recorded is 16,582 sq km, which is about 6.88% of the total geographical area of the state. Most of the forest is found in the Bhabar and Terai regions in the Gangetic Plain (ENVIS centre: UP, 2022). The existing flora in Uttar Pradesh can be classified into three categories.

- Humid tropical deciduous forest
- Dry tropical deciduous forest
- Tropical thorn forest

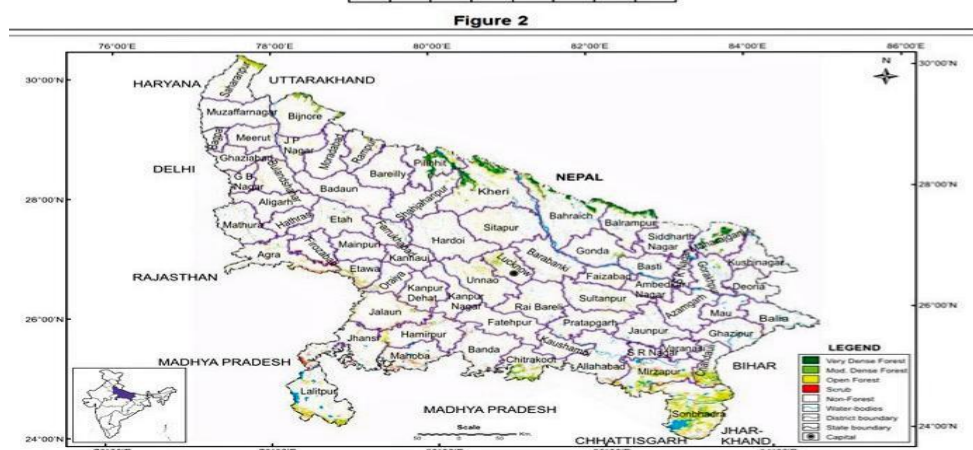
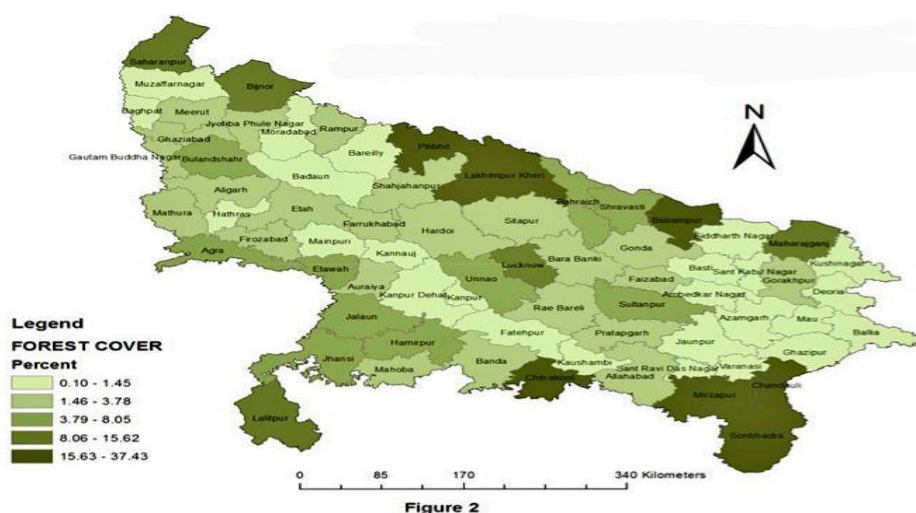


Figure 1: (a) Forest cover in Uttar Pradesh in percentage, (b) Forest cover map of Uttar Pradesh (Forest survey of India, 2019).

Protected Area of Uttar Pradesh

According to the International Union for Conservation of Nature, a protected area is a clearly defined geographical area recognized, dedicated, and organized for the long-term conservation of nature and its associated environmental services and cultural values. Usually, in these areas there are limits or a complete ban on the use

of human occupations and natural resources. A protected area or protected area is an area that is being protected from alteration or loss due to its natural, environmental or cultural importance. Protected areas are of different types and are given different levels of protection. Some marine areas are also often protected. As of October 2010, there were over 1,61,000 protected areas

worldwide comprising 10–15% of the world's entire landmass. In contrast, only 1.17% of the ocean was

covered by protected areas. It had an area of about 6,800 maritime defenses.

Table 1: Protected area of Uttar Pradesh.

Protected area	Examples with location
National Park	Dudhwa National Park
Wildlife Sancturries	<ul style="list-style-type: none"> • Suhelva Sanctuary, Balrampur, Gonda, and Shravasti • Parvati Arga Bird Sanctuary, Gonda • Sohagi Barwa Sanctuary, Maharajganj • Katarniaghat Wildlife Sanctuary, Bahraich • Bakhira Sanctuary, Sant Kabir Nagar • Kishanpur Wildlife Sanctuary, Lakhimpur Kheri • Sarsai Nawar Wetland, Sarsai Nawar, Etawah • Chandra Prabha Wildlife Sanctuary, Chandauli • Hastinapur Wildlife Sanctuary, Amroha, Bijnor, Ghaziabad, Meerut, and Muzzafarnagar districts • Kachhua Sanctuary, Varanasi • Kaimoor Sanctuary, Mirzapur and Sonbhadra districts • Lakh Bahosi Sanctuary, Kannauj • Mahavir Swami Sanctuary, Lalitpur • National Chambal Wildlife Sanctuary, Agra and Etawah district • Nawabganj Bird Sanctuary, Unnao • Okhla Sanctuary, Ghaziabad, and Gautam Buddha Nagar districts • Patna Bird Sanctuary, Etah • Ranipur Sanctuary, Banda and Chitrakoot districts • Samaspur Sanctuary, Rae Bareli • Sandi Bird Sanctuary, Hardoi • Sur Sarovar Sanctuary, Agra • Suraha Tal Sanctuary, Ballia • Vijai Sagar Sanctuary, Mahoba • Saman Sanctuary, Mainpuri
UNESCO Ramsar sites	<ul style="list-style-type: none"> • Bakhira Sanctuary, Sant Kabir Nagar • Parvati Arga Bird Sanctuary, Gonda • Nawabganj Bird Sanctuary, Unnao • Sur Sarovar also called, Keetham Lake, Agra • Saman Bird Sanctuary, Mainpuri • Samaspur Bird Sanctuary, Rae Bareli • Sandi Bird Sanctuary, Hardoi • Sarsai Nawar Jheel, Etawah • Haiderpur Wetland, Muzaffarnagar and bijnor districts • Upper Ganga River (Brijghat to Narora Stretch)

There are a total of 25 Wildlife Sancturries, one national park, one Safari Park, and many Tiger reserves in Uttar Pradesh. The famous Dudhwa National Park of Uttar Pradesh is a park located in the Lakhimpur-Khiri district of Uttar Pradesh on the Indo-Nepal border, which is a special place for nature lovers and wildlife lovers. It is the only national park in Uttar Pradesh. It is spread over an area of 811 square kilometers in the Indo-Gangetic plain. It was established in 1985 and became a part of Project Tiger in 1987. Dudhwa National Park is considered to be the habitat of rare and endangered species like Bengal Florican, Tiger, Speed Hare, Swamp Deer (Barasingha), and Leopard (UNEP, 2013; Botanical Survey of India, 2022).

Rare & Threatened Angiosperms of Uttar Pradesh

India has 18, 00 species of flowering plants. Many of them are of huge ecological and economic importance. Following is a list of some flowering plants of Uttar Pradesh that are gradually decreasing in number in wild.

Table 2: Threatened and rare species of Uttar Pradesh (Botanical survey of India, 2022).

Plant species	Family	BSI Status
<i>Aconitum variegatum</i> L.	Ranunculaceae	Rare
<i>Aconitum heterophyllum</i> Wall. ex Royle	Ranunculaceae	Rare
<i>Arnebia benthamii</i> (Wall. ex G. Don) I.M. Johnst.	Boraginaceae	Rare
<i>Berberis affinis</i> G.Don	Berberidaceae	Rare
<i>Berberis lambertii</i> R. Parker	Berberidaceae	Vulnerable
<i>Berberis osmastonii</i> Dunn	Berberidaceae	Rare
<i>Berberis petiolaris</i> Wall. ex G. Don var. <i>garhwalana</i> Ahrendt	Berberidaceae	Rare
<i>Catamixis baccharoides</i> Thomson	Asteraceae	Rare
<i>Circaeaster agrestis</i> Maxim.	Circaeasteraceae	Rare
<i>Derris kanjilalii</i> K.C. Sahni <i>et al.</i> H.B. Naithani	Fabaceae	Endangered
<i>Derris macrocarpa</i> Thoth.	Fabaceae	Endangered
<i>Dicranostigma lactucoides</i> Hook.f. & Thomson	Papaveraceae	Endangered
<i>Eremostachys superba</i> Royle ex Benth.	Lamiaceae	Endangered
<i>Wulfenia himalaica</i> (Hook.f.) Pennell	Scrophulariaceae	Endangered
<i>Kashmiria himalaica</i> (Hook.f.) D.Y. Hong	Scrophulariaceae	Rare
<i>Trachycarpus takil</i> Becc.	Arecaceae	Rare
<i>Peucedanum dehradunense</i> Babu	Apiaceae	Endangered
<i>Ligusticum marginatum</i> C.B. Clarke	Apiaceae	Rare
<i>Poa rhadina</i> Bor	Poaceae	Rare
<i>Nardostachys grandiflora</i> DC.	Valerianaceae	Rare
<i>Aphyllorchis gollani</i> Duthie	Orchidaceae	Endangered
<i>Calanthe alpina</i> Hook.f. ex Lindl.	Orchidaceae	Rare
<i>Calanthe mannii</i> Hook.f.	Orchidaceae	Rare
<i>Calanthe pachystalix</i> Rechb.f. ex Hook.f.	Orchidaceae	Endangered
<i>Calanthe plantaginea</i> Lindl.	Orchidaceae	Rare
<i>Cymbidium mackinnonii</i> Duthie	Orchidaceae	Rare
<i>Cypripedium elegans</i> Rechb.f.	Orchidaceae	Rare
<i>Dactylorhiza hatagirea</i> (D. Don) Soo	Orchidaceae	Vulnerable
<i>Dendrobium primulinum</i> Lindl.	Orchidaceae	Rare
<i>Impatiens jaeschkei</i> Hook.f.	Balsaminaceae	Vulnerable
<i>Impatiens langeana</i> Hook.f.	Balsaminaceae	Endangered
<i>Impatiens podocarpa</i> Hook.f.	Balsaminaceae	Endangered
<i>Impatiens polysciadia</i> Hook.f.	Balsaminaceae	Endangered
<i>Impatiens reidii</i> Hook.f.	Balsaminaceae	Endangered
<i>Indoptadenia oudhensis</i> (Brandis) Brenan	Leguminosae	Critically Endangered
<i>Iris duthiei</i> Foster	Iridaceae	Endangered

Description of some selected threatened plants**1. *Indoptadenia oudhensis* (Brandis) Brenan**

Family-Leguminosae-mimosoideae.

Locality in Uttar Pradesh-West & Central the Himalaya to North India (North Uttar Pradesh).

Indoptadenia oudhensis (Brandis) Brenan (Syn. *Piptadenia oudhensis* Brandis) is a monotypic genus. It is threatened and an endemic tree genus of tropical moist deciduous forest of lower foothills of the Himalaya. It is distributed in the central parts of the lower foothills of the Himalayas in the border zone between India and Nepal especially the Terai region of the Bhabar zone which lies in tropical moist deciduous forest. It is commonly known as Gainti and Hathipaula. It is scattered between 150–900 m altitudes in the Himalaya zone. In Uttarakhand (India), the species are found only in the Champaran district and categorized as threatened by local forest communities. Due to high logging, its seed

production and regeneration potential are affected. This monotypic genus is critically endangered; therefore, conservation strategies are required immediately to protect it from extinction (Singh *et al.*, 2011 and Kew Science, 1955).



Figure 2. *Indoptadenia oudhensis* (Brandis) Brenan. a) Representative species, b) Herbarium specimen (Dhakad *et al.*, 2020).

2. *Derris macrocarpa* Thoth.

Family: Leguminosae

Locality in Uttar Pradesh: Bahraich

It is an endangered climbing shrub. Leaves are alternate, stipulate, and imparipinnate, it has 7-9 opposite leaflets, and the apex is obtuse, sometimes shortly cuspidate. It has racemose inflorescence. Pods are winged on both sutures and flat. Flowers are faintly veined. Fruiting occurs in April-May (IUCN, 2022).

3. *Calanthe mannii* Hook.f.

Family: Orchidaceae

Locality in Uttar Pradesh: Garhwal and Kumau

It is a rare species of Uttar Pradesh. Globally it is found in Myanmar, southern China, Vietnam, Western Himalayas, Assam, Eastern Himalayas, and Nepal. It occurs in dense rainforests and secondary, mossy grasslands in foothills at elevations of 600 to 2400 meters. It is found as a small or medium-sized, warm to cold growing terrestrial with short, cylindric pseudobulbs. It carries 4-5, narrowly elliptic-oblong to oblanceolate-oblong, acute to subacute, plicate, 5 nerved, gradually narrowing below into the petiolate base leaves that blooms in the spring on a terminal, laxly 10 to 20 flowered, pubescent. It has a 27-56 cm long inflorescence with glabrous, small, lanceolate, acute

floral bracts. Its flower size is .5-1.3 cm (Rao and Kumar, 2024).



Figure 3: *Calanthe mannii* Hook.f. Plant.

Endemic Angiosperms of Uttar Pradesh

Endemism is the state of a biological species in which it is originally found only in a limited geographical area, such as an island, state, country, or any other defined area. Even if a species is found originally someplace, it is not said to be endemic for that place if it is found in other places also. The exact opposite of neutrality is the condition of universal distribution, in which a species is found throughout the world or in most parts of the world.

Table 3: Some Endemic plant species of Uttar Pradesh (Botanical Survey of India, 2022).

Family	Plant species
Aceraceae	<i>Acer oblongum</i> Wall. ex DC. var. <i>membranaceum</i> Banerji
Scrophulariaceae	<ul style="list-style-type: none"> • <i>Alectraparasitica</i> A. Rich. var. <i>chitrakutensis</i> (M.A. Rau) K.K. Khanna & An. Kumar • <i>Wulfenia himalaica</i> (Hook.f.) Pennell • <i>Kashmiria himalaica</i> (Hook.f.) D.Y. Hong • <i>Wulfenia himalaica</i> (Hook.f.) Pennell
Fabaceae	<ul style="list-style-type: none"> • <i>Alysicarpusrox burghianus</i> Thoth. & A. Pramanik • <i>Astragalus aegacanthoides</i> R. Parker • <i>Astragalus kashmirensis</i> Bunge • <i>Astragalus pindreensis</i> (Baker) Ali • <i>Derris macrocarpa</i> Thoth. • <i>Erythrina resupinata</i> Roxb. • <i>Hedysarum microcalyx</i> Baker • <i>Indigofera cedrorum</i> Dunn
Orchidaceae	<ul style="list-style-type: none"> • <i>Aphyllorchis gollani</i> Duthie • <i>Archineottia microglottis</i> (Duthie) S.C. Chen • <i>Didiciea cunninghami</i> King &Prain • <i>Cymbidium mackinnonii</i> Duthie
Caryophyllaceae	<i>Arenaria ferruginea</i> Duthie ex F.N. Williams
Berberidaceae	<ul style="list-style-type: none"> • <i>Berberis affinis</i> G.Don • <i>Berberis lambertii</i> R. Parker • <i>Berberis osmastonii</i> Dunn • <i>Berberis petiolaris</i> Wall. ex G. Don var. <i>garhwalana</i> Ahrendt
Asteraceae	<i>Cicerbitafilicina</i> (Duthie ex Stebbins) Aswal& Goel
Rubiaceae	<i>Clarkella nana</i> (Edgew.) Hook.f.
Rosaceae	<ul style="list-style-type: none"> • <i>Cotoneaster garhwalensis</i> • <i>Cotoneaster osmastonii</i>

	<ul style="list-style-type: none"> • <i>Cotoneaster pangiensis</i> • <i>Cotoneaster prostratus</i> Baker • <i>Cotoneaster stracheyi</i> • <i>Cotoneaster wattii</i>
Campanulaceae	<i>Cyananthus integer</i> Wall. ex Benth.
Poaceae	<i>Chimonobambusa jaunsarensis</i> (Gamble) Bahadur & H.B. Naithani
Gentianaceae	<ul style="list-style-type: none"> • <i>Gentiana saginoides</i> Burkill • <i>Gentiana tetrasepala</i> Biswas
Balsaminaceae	<ul style="list-style-type: none"> • <i>Impatiens jaeschkei</i> Hook.f. • <i>Impatiens langeana</i> Hook.f. • <i>Impatiens podocarpa</i> Hook.f. • <i>Impatiens polysciadia</i> Hook.f. • <i>Impatiens reidii</i> Hook.f.
Iridaceae	<i>Iris duthiei</i> Foster
Iteaceae	<i>Itea nutans</i> Royle
Boraginaceae	<i>Ivanjohnstonia jaunsariensis</i> Kazmi
Berberidaceae	<i>Mahonia jaunsarensis</i> Ahrendt
Apiaceae	<i>Meeboldia selinoides</i> H. Wolff.
Cyperaceae	<ul style="list-style-type: none"> • <i>Microschoenus sduthiei</i> C.B. Clarke • <i>Microschoenus falconeri</i>
Pittosporaceae	<i>Pittosporum eriocarpum</i> Royle
Poaceae	<ul style="list-style-type: none"> • <i>Poa jaunsarensis</i> Bor • <i>Poa pseudamoena</i> Bor • <i>Poa pseudamoena</i> Bor • <i>Poa rhadina</i> Bor • <i>Pseudodanthoniahi malaica</i> (Hook.f.) Bor& C.E. • <i>Trisetum scitulum</i> Bor
Papilionaceae	<i>Pueraria stracheyi</i> Baker
Areaceae	<i>Trachycarpustakil</i> Becc.

Rare & Threatened Angiosperms of Terai region of Uttar Pradesh

1. *Rauvolfia serpentina*

Family: Apocynaceae

Rauvolfia serpentina (Hindi name: Sarpagandha) is a dicotyledonous, multi-year shrub. The height of the plant ranges from 6 inches to 2 feet. Its main root is usually 20 cm. m. It is long. There is no branch in the root. It has a simple leaf. Its stem is covered with thick bark. Its flowers are pink or white. These are found in clusters. It is cultivated in flat and mountainous regions of India. Many pharmaceutically important crops have been reported from this plant including reserpine, rescinnamine, yohimbine, and serpentine are of pharmaceutical importance. Apart from snake bite, applying it in the place of a scorpion bite also gives relief. The medicine is made from the root, stem, and leaves of this plant. Medicines are used to prevent diseases like hysteria etc., 1.7 to 3.0 percent alkalis are found in it, in which reserpine is the main, its property is rough, bitter in juice, bitter in vital and its effect is sedative. The root of a two-three-year-old plant is uprooted and kept in a dry place, the medicines made from it are used in the treatment of high blood pressure, and contraction in the uterine wall. Squeezing the juice of its leaf is used as a medicine for the eyes. Its use is used to make medicine for the brain. The juice of the root of *R. serpentina* is very useful in removing

insomnia, hysteria, and mental stress. The powder of its root is very beneficial for the stomach. This kills the worm inside the stomach (Soumi *et al.*, 2022).

2. *Gloriosa superba*

Family: Colchicaceae

Gloriosa superba (Flame Lily) is a beautiful perennial herbaceous vine; It is a member of the Colchicaceae family. It is also known as Agnishikha because of its beautiful flowers. It is commonly found in the forest. It has oblong, V-shaped rhizomes. It is found in Africa, Asia, Sri Lanka, and the United States of America. It is found in tropical India from the northwest Himalayas to Assam and the southern peninsula. This shrub is very useful in the treatment of ulcers, leprosy, and piles. Its tubers are very effective in the treatment of piles, cancer, and impotence. It is also very useful in cases of burning, stomach pain, itching, sterility, stomach worms, and skin problems. Its seeds are used for rheumatic diseases. Tubers are used for the treatment of tonic and snakebite in Indian systems of medicine. The juice of the leaves is used to kill hair lice (Mishra and Sharma, 2020).

3. *Dioscorea bulbifera*

Family: Dioscoreaceae

Dioscorea bulbifera (Hindi name: VarahiKand) is a beautiful creeper is found spreading on the roadside trees in the rainy season up to a height of about 1850 m in the

Himalayan regions of India. There are small fibers in its tuber which looks like the hair of a Varaha (pig), hence it is called the Varahi tuber. In the axis of its leaf, there is a bulbil which is brown in color and circular, from which new plants emerge. It is also called air potato. It is eaten by boiling or roasting it. Its tuber is not particularly big. It looks like a pig's mouth, thick on one side and thin on the other side, it is white with solid, dense long hairs inside and black or beige-brown above. Milk comes out when it is cut or scraped with fingernails, it is bitter and charred in taste. It has an ascending creeper like Varahi. Small thorns are found at the base of the stems. Male and female flowers are arranged separately in the manjari. Its tubers are long, dark, gray or black, and hairy. The tuber is used in the treatment of all-around colic, fissure, flow, inflammation, and swelling. It is found effective in Diabetes, cancer, oxidative stress, Pain, and Swelling (Kundu *et al.*, 2021).

4. *Flacourtia indica*

Family- Salicaceae

Flacourtia indica (Hindi name: Paniyala), commonly known as Indian plum is a genus of flowering plants native to tropical and temperate parts of Africa and Asia. Species *F. Indica* and *F. ramontchi* are sometimes treated as separate species. It is a bushy shrub or tree with a spiny trunk and branches. As a shrub, it grows up to 25 feet (7.6 m) and like a tree, it reaches a maximum height of about 50 feet (15 m). On sloping branches, there are oval leaves. The seeds are scattered by the birds. The Ramonchi fruit itself is an apple about an inch thick and ripening red to purple. It is very fleshy and contains 6 to 10 seeds in a layered carpel. The pulp is yellow or white and is sweet with an acidic touch. It is eaten raw or made into jelly or jam. It can be fermented to make wine. The leaves and roots are used in herbs for the treatment of snakebite. It is believed to be effective for psoriasis. Most parts of the plant are used for bacterial infections of cough, pneumonia, and throat. It has also been used for diarrhea (Singh and Singh, 2010).

5. *Commiphora wightii*

Family: Burseraceae

Commiphora wightii (Hindi name: Guggal) is a small tree. A substance like 'resin' obtained from it is also called 'guggal'. It grows only in the rainy season and leaves appear on it at this time. During the remaining time i.e., winter and summer season, its growth gets stunted and becomes foliar. Generally, the Guggal tree is 3-4 meters high. White-colored milk comes out from its stem, which is the useful part of it. The color of Guggal obtained from some places is yellowish-white and others are dark red. It has a sweet smell. When it is put in the fire, the place gets filled with fragrance. That is why it is treated like incense. According to Ayurveda, it is bitter, pungent, and hot and is anti-phlegm, talkative, worm, worm, clad, inflammatory and anti-inflammatory. It grows naturally in the states of India, Karnataka, Rajasthan, Gujarat, and Madhya Pradesh. It has come on the verge of extinction in India, so there is a need to

cultivate it in large areas. Due to the high demand for Guggul in India and low production, it is imported from Afghanistan and Pakistan (Uzma *et al.*, 2022).

6. *Glycyrrhiza glabra*

Family: Fabaceae

Glycyrrhiza glabra (Hindi name: Mulethi) is also known as licorice. It has pink and purple flowers. Its fruits are long, flat, and thorny. Its leaves are compound. Small roots emerge from the primary roots. Its cultivation is done all over India. Liquorice is a famous and universal herb. Due to the sweetness of Kand and the root, the liquorice is called Yashtimadhu. Other names are MadhukKlitak, Jethimadh, and Licorice. Its multi-year-old Sun is about one and a half meters to two meters high. Roots are round-long, wrinkled, and spreading. Many branches emerge from the root and stem. The leaves are compound and elliptical, with pointed tips. The pods are small, two and a half centimeters long, flat, in which there are two to five kidney-shaped seeds. The underground stem (kand) and root of this tree are dried by removing the skin or the parts with the peel are used. Liquorice is useful in the treatment of cough, sore throat, colic, tuberculosis, inflammation of the windpipe, and epilepsy. Consumption of liquorice is also beneficial for the eyes. It has an antibacterial ability. It is also beneficial in internal injuries of the body. In India, it is used by putting it in paan, etc (Hasan *et al.*, 2021).

7. *Withania somnifera*

Family: Solanaceae

Withaniasomnifera (Hindi name: Ashwagandha) is traditionally used in India for Ayurvedic treatment. Along with this, it is also grown as a cash crop. Ashwagandha got its name due to the smell of horse urine in its fresh leaves and roots. Plants of this species are straight, highly branched, evergreen, and bushy 1.25 m tall plants. The leaves are pubescent and elliptical. The flowers are green, yellow, and small and are arranged in group of five. Its fruit is a berry which is like a pea containing milk which turns red when cooked. Roots 30-45 cm long 2.5-3.5 cm thick are like radish. The outer color of their roots is brown and it is white inside. The concentration of alkaloids ranging from 0.13 to 0.31 percent is found in the roots of Ashwagandha. It contains the important withanine alkaloids, which account for 35 to 40 percent of the total alkaloids (Singh *et al.*, 2010).

8. *Chlorophytum tuberosum*

Family: Asparagaceae

Chlorophytum tuberosum (Hindi name: Safed Musli) is found only in India. The major producing states of Safed Musli in India are Gujarat, Maharashtra, and Rajasthan. It is an Ayurvedic herb that is often found in the tropical forests of India. It pacifies Vata and Pitta dosha but increases Kapha. Usually, it grows on its own in wet areas or forests, but in some places, it is also cultivated. Its plant is about 1.5 feet tall. It helps in developing sexual ability. It helps increase the testosterone level. It

also relieves erectile dysfunction. It also enhances immunity. It is also helpful in removing stress and anxiety. It helps get rid of diabetes. Its consumption also helps in controlling weight. It is beneficial for women during pregnancy (Patil and Deokule, 2022).

9. *Holoptelea integrifolia*

Family- Ulmaceae

Holoptelea integrifolia (Hindi name: Chilbil) is a versatile medicinal plant that is routinely used in various indigenous systems of medicine to treat health care maladies. The plant species originated from the Pacific Islands. In India, it extends up to 2000 feet in the outer

Himalayan region from Jammu to the east and from Bengal in the south to the Ceylon dry region in central, western, and southern India. This plant is a large deciduous tree, which grows up to 25 meters high. Its bark is 6-8 mm thick, smooth with whitish-pubescent branches. Its leaves are simple, alternate, and sharp in shape from the front. When the bark is crushed further its bark produces a pungent odour. Its flowers are small, greenish-purple, and polygynous and are found in the axillary fascia. *H. integrifolia* tree is majorly used in the treatment of stomach-related diseases. Apart from this, this plant is also useful in the treatment of joint pain and herpes scabies (Saraswathiyet *et al.*, 2008).

Table 4: Rare & Threatened Angiosperms of Terai region of Uttar Pradesh.



1. *Rauvolfia serpentina*



2. *Gloriosa superba*



3. *Dioscorea bulbifera*



4. *Flacourtia indica*



5. *Commiphora wightii*



6. *Glycyrrhiza glabra*



7. *Withania somnifera*



8. *Chlorophytum tuberosum*



9. *Holoptelea integrifolia*

MICROPROPAGATION: A GREAT MODE OF CONSERVATION

Due to over-exploitation and habitat destruction, many plants are on the verge of extinction. There is a rich diversity of flowering plants in Uttar Pradesh, many of which are economically important. Tissue culture is a

method by which many copies of a plant can be produced in a short time. It is one of the best ways to conserve endemic and threatened plants. Apart from conservation, this method is also useful in the production of secondary metabolites from medicinal herbs. The present annual demand for Glory Lily is very high. Due

to enhanced demand and low production, it is harvested from the wild at a high rate. This plant species has become endangered in Asian countries hence facing local extinction and it is included in the 'Red Data Book' by the International Union for Conservation of Nature (IUCN). Naturally, Glory lily reproduces by seeds and tubers, but it has bad seed germination which can take 3 weeks to months and its tubers have low regeneration frequency. The bad seed germination is due to water-impermeable hard seed coat which restricts its use in commercial cultivation. Seeds become water-permeable only after many cycles of cold and heat environments (Mishra and Sharma, 2021).

CONCLUSION

Biodiversity helps in maintaining ecological balance. In addition, it offers protection against environmental disasters like droughts and floods. Anthropogenic activities like logging leads to habitat destruction, if such activities are not curbed then they may lead to disturbance in the biological ecosystem. Flora of Uttar Pradesh is a rich source of herbal remedies, many tribal communities possess good traditional knowledge about ethnomedicines. The establishment of some more protected areas like national parks, wildlife sanctuaries, wetlands, and biosphere reserves is required in Uttar Pradesh for the conservation and protection of valuable biodiversity. Hence, there is an urgent need to prioritize useful threatened plants and conserve them ex-situ and in-situ for sustainable growth. Scientists, researchers, and the government need to pay attention to the flora of Uttar Pradesh.

REFERENCES

1. A Saraswathy, S Nandini Devi, D Ramasamy. "Antioxidant, heavy metals and elemental analysis of *Holoptelea integrifolia* Planch" *Ind J Pharm Sci*, 2008; 70(5): 683-576.
2. About Protected Areas, Accessed date: 22.03.2022, Available from: https://archive.is/2013.04.16-003240/http://www.unep-wcmc.org/about-protected-areas_163.html.
3. Dhakad AK, Pandey VV, Kumar R, Thakur A, et al. "Molecular taxonomy of *Indopiptadenia oudhensis* (Brandis) Brenan (Leguminosae – Mimosoideae) - A threatened Indian endemic monotypic genus". *Curr Bot*, 2020; 11: 28-33.10.25081/cb.2020.v11.5977.
4. Endemic and threatened taxa, Accessed date: 22.03.2022, Available from: http://bsienviis.nic.in/Database/Endemic_and_Threatened_taxa_3942.aspx.
5. Hasan Kamrul Md et al. Phytochemistry, pharmacological activity, and potential health benefits of *Glycyrrhiza glabra*, *Heliyon*, 7(6): 2021, Available from: <https://doi.org/10.1016/j.heliyon.2021.e07240>
6. Home: ENVIS Centre – UP, Status of Environment and Related Issues, Accessed date: 22.03.2022, Available from: <http://upenviis.nic.in>.
7. *Indopiptadenia oudhensis* (Brandis) Brenan | Plants of the World Online | Kew Science, Accessed date: 11.04.2022, Available from <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:500205-1>.
8. IOSPE photos, Accessed date: 24.03.2022, Available from: <http://www.orchidspecies.com/calmannii.htm>.
9. J.J. Morrone, Endemism, Editor(s): Brian Fath, Encyclopedia of Ecology (Second Edition), Elsevier, 2008; Pages 81-86, ISBN 9780444641304, <https://doi.org/10.1016/B978-0-444-63768-0.00786-1>.
10. Kundu BB, Vanni K, Farheen A, Jha P, et al. "*Dioscorea bulbifera* L.(Dioscoreaceae): A review of its ethnobotany, pharmacology and conservation needs". *South African J of Botany*, 2021 [cited 11 April 2022]; 140: 365-374. Available from <https://doi.org/10.1016/j.sajb.2020.07.028>.
11. Mishra T, Sharma P. "A Critical Review of Glory Lily: A Rare Medicinal Plant". *World J Pharmacy and Pharmaceutical Sci*, 2020; 9(10): 1123-1133.
12. Mishra T, Sharma P. "Vegetative propagation of Glory Lily". *Suraj Punj J of Multidis Res*, 2021; 11(1): 168-173.
13. Patil VN, Deokule SS. "Pharmacognostic study of *Chlorophytum tuberosum* Baker", *Int J Ayurveda research*, 2020; 1(4): 237-242.
14. Protected Planet, Accessed date: 23.03.2022, Available from: <https://web.archive.org/web/20150308031911/http://www.protectedplanet.net/search>.
15. Publications| IUCN, Accessed date: 23.03.2022, Available from: <https://www.iucn.org/resources/publications>.
16. Sankara Rao, K., Deepak Kumar (2024). India Flora Online. http://indiafloraonline-cs.iisc.ac.in/plants.php?name=Calanthe_mannii. Downloaded on 31 July 2024. Morrone J.J. Endemism, Encyclopedia of Ecology (Second Edition), 2008; 3(2): 81-86, <https://doi.org/10.1016/B978-0-444-63768-0.00786-1>.
17. Singh AK, Singh J. "Evaluation of anti-diabetic potential of leaves and stem of *Flacourtia jangomas* in streptozotocin-induced diabetic rats". *Ind J Pharm*, 2010; 42(5): 301-305.
18. Singh G, Sharma PK, Dudhe R, Singh S. "Biological activities of *Withania somnifera*" *Ann Biol Res*, 2010; 1(3): 56-63.
19. Singh NP, Lakshminarasimhan P, Karthikeyan S, Prasanna PV (2001). Flora of Maharashtra state, Dicotyledones. Vol. 2, pp-959. Botanical survey of India, Govt. India.
20. Sankara Rao, K., Raja K Swamy, Deepak Kumar, Arun Singh R. and K. Gopalakrishna Bhat (2019). Flora of Peninsular India. Available from: http://peninsula.ces.iisc.ac.in/plants.php?name=Derris_macrocarpa. Downloaded on 24 March 2022.

21. Soumi P, Sivasudha T, Gayathri N, Abbirami E, et al. *Rauwolfia serpentina*: A Potential Plant to Treat Insomnia Disorder. Sleep and Vigilance. [Internet] 2022 [cited 10 April 2022], Available from: <https://doi.org/10.1007/s41782-021-00192-y>.
22. Tilman David, Reich Peter B, Knops Johannes MH (2006). "Biodiversity and ecosystem stability in a decade-long grassland experiment". Nature, 2006; 441(7093): 629-632.
23. UP STATE BIODIVERSITY BOARD, Accessed date: 22.03.2022, Available from: www.upsbdb.org.
24. Uzma M, DhanwiniR. Prasad, Sunayana N, Vinay B, et al. Studies of *invitro* antioxidant and anti-inflammatory activities of gold nanoparticles biosynthesised from a medicinal plant, *Commiphora wightii*, Materials Technology, [Internet] 2021[cited 11 April 2022; Available from: DOI: 10.1080/10667857.2021.1905206.
25. Welcome To Forest Survey of India, Accessed date: 04.01.2022, Available from: <https://fsi.nic.in/isfr19/vol2/isfr-2019-vol-ii-uttar-pradesh.pdf>.