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BIODIVERSITY OF INDIA THROUGH AGES: PAST, PRESENT AND FUTURE

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Abstract

The present paper deals with the studies on 'Biodiversity of India' made in the past, efforts undertaken at present and indications towards future perspectives. The **past studies** referes about the biodiversity documented in the ancient Vedic Literature (2500 to 500 BC) comprising of Veda, Brahmanas, Aranyakas, Upnishadas and Kalpasutradi Vedangas. It also includes the post Vedic Literature (500 BC to 1000 AD) having the prominent writings of Panini and Jeewak and those of Kautilya Arthashastra, Vatsyanas Kamasutra, Bruhat-samhita including Vrikshayurved, Dravid and others before the 10th century. The plant biodiversity mentioned in these literature refers about cereals, pulses, vegetables, fruits, fibers, oils and medicines.

The Ayurvedic literature (1000 to 1500 AD) included in Charak samhita, Sushrut- samhita, Nighantu-granthas written by various authors, Shukra-nitisar and Sharngadhar-samhita report about the biodiversity of medicinal plants, their methods of identification, propagation, preservation and utilization for preventing and curing the human diseases. After 15th century the 'Biodiversity of India' was studied by Europeans including Portugese, Dutch, Danish and English workers who visited India for trade or other reasons. The biodiversity recorded by them have been given in their prominent writings such as 'Coloquios Des Simples E Drogas De India, The Herbarium Amboinense, Flora Indica, Flora of British India, etc. The **present studies** on biodiversity of India are going at many National and State research institutes, Universities, Colleges, Departments, NGO's and other organizations located in various geographical and

climatic zones of India which have documented the voluminous literature. The government is taking many efforts to protect the prestigious biodiversity of India through established 75 National parks, 42 Sanctuaries, 14 Biospher reserves and many Botanical gardens, Zoos, Gene banks and Cryopreservations. However, '**the future perspective**' about the biodiversity of India seems to be declining. The industrialization, urbanization and trading have resulted in extinction of important plant and animal species and many others have been kept on the verge of extinction. The shifting of human thinking from "Greed-based" to "Need-based" ideology alone can only help to prevent the further destruction of this valuable wealth. All these above mentioned aspects have been discussed by the present authors.

Keywords : Biodiversity through ages, Biodiversity of India, Biodiversity in Vedic literature, Biodiversity in post Vedic Literature,

Biodiversity of India through ages:

The present paper deals with the Biodiversity of India through ages. The authors have summarized the '**Past work**' made in this context right from the ancient Vedic period upto the establishment of Botanical Survey of India (B.S.I.), Calcutta and '**Present Biodiversity Studies**' undertaken through various agencies at National level. In order to mention the '**Future perspective**', the loss of biodiversity of our nation has also been enlisted.

(A) Biodiversity in the past:

a) Biodiversity in ancient Vedic literature:

The biodiversity of India has been studied '**in the past**' since the Vedic times. The ancient Vedic Literature (2500 to 500 BC) comprises of Vedas, Brahmanas, Aranyakas, Upnishadas and Kalpasutradi Vedangas. In this literature, there seems to be a tendency of classifying the plants on different basis i.e. a) cultivated and wild cereals and b) medicinal plants for human and animals. In Atharva-Veda-Samhita 8.4.7 the plants have been classified as Prastumati (Spreading), Stambini (Shruby), Ekshringa (Unbranched), Pratanwati (Creeper), Anshumati (with many germinating points), Kandini (long internodes) and Vishakha (multibranched). The Table 1 gives an idea about the various categories and related examples of plants known to them. The biodiversity reported in the Vedic literature refers to more than 220 plants which were used as food crops, medicinal plants and worshiping plants including 'Yadnya'.

Table 1 : Plant categories and examples in ancient Vedic literature.

Sr.No.	Plant Categories	Examples
01	Roots	Wala (*Vetivera zizanoides*)
02	Cereals	Godhum (*Triticum aestivum*), Vrihi (*Oryza sativa*)
03	Cereals in water	Udakya (Udshamak)
04	Fruits	Urvasak (*Cucumis sativas*)
05	Medicinal	Ashmagandh (*Withania somnifera*), Baj (*Brassica campestris)*
06	Aromatic	Guggul (*Commiphora mukul*)
07	Sugar	Ikshu (*Saccharum officinarum*)
08	Poison	Apamarg (*Achyranthus aspera*), Shalmali (*Salmalia malbarica)*
09	Grasses	Ashwawar, Upalan, Ulap
10	Trees	Ashwath (*Ficus religiosa*), Parna (*Butea frondosa*)
11	Seven domestic crops	Til (*Sesamum indicum*), Udid (*Dolichous biflorus*), Tandul (*Oryza sativa*), Java (*Hodeum vulgare*), Priyanga, Anu and Gahu (*Triticum aestivum*)
12	Sevan wild crops	Sawe , Niwar, Jatil, Gaweduk, Garmut, Wastava and Venuyava

Biodiversity in post Vedic literature:

The 'post vedic period literature' (500 BC to 1000 AD) includes the writings of Panini and Jeevak and those of Kautilya's Arthashastra, Vatsyana's Kamasutra, Bruhatsamhita including 'Vrikshayurveda', Dravidi and other literature before the 10th Century. The following table gives an idea about the various plant categories and related examples included in the literature of this period, particularly reported in Kautilya Arthashastra, Shukraniti and Kamandakiya Nitisar.

Table 2 : Plant categories and examples in Kautilya Arthashastra, Shukraniti and Kamandakiya Nitisar

Sr. No.	Plant Categories	Examples
01	Cereals	Brihi (*Oryza sativa*), Godhum (*Triticum aestivum*)
02	Pulses	Masoor (*Lens esculentas*), Chanak (*Cicer arietinum*)
03	Vegetables	Moolak (*Raphanus sativus*) Alook (*Solanum tuberosum*) Lashoon (*Allium sativum*), Palandu (*Allium cepa*)
04	Spices	Dhane (*Coriandrum sativum*), Ale (*Zingiber officinalis*)
05	Oils	Nimb (*Azadirachta indica*), Til (*Sesamum indicum*)
06	Sugars	Sakhar (*Saccharum officinarum*), Khadisakhar
07	Fruits	Pomengrate (*Punica granatum*), Grapes (*Vitis vinifera*)
08	Madya	Decoction of *Madhuca indica* flowers, Aasaw, Arisht

The biodiversity reported in the post Vedic literature refers about cereals, pulses, vegetables, fruits, fibres, oils, alcoholic breverages, medicinal plants, timber and worshiping plants. In this period the plant biodiversity was maintained with the help of agriculture and medical science of those days.

b) Biodiversity in Ayurvedic literature:

The Ayurvedic literature (1000 to 1500 AD) includes mainly Charak-Samhita, Sushrut-Samhita, Nighantu-granihas written by various authors, Shukra-nitisar and Sharangdhar-Samhita. The plant Varga (groups) and examples reported in Sushrut-Samhita are as follows.

Table 3 : Plant varga (groups) and examples in Sushrut-samhita.

Sr. No.	Plant varga (Groups)	Examples
1	Shalivarga	
	a) Shali	Kanchanak (*Bauhinia variegata*), Pushpandak
	b) Shashtik	Asanapushpak, Mahashashtik
	c) Vrihi	Patal (*Stereospermum suaveslens*), Krishnavrihi
2)	Kudhanya varga	
	a) Kudhanya	Todaparni, Mukund, Madhulika
	b) Baidal (Vaidal)	Masur (*Lens esculenta*), Chanak (*Cicer arietinum*)
3)	Phalvarga (Fruits)	
	a) Amlavarga	Amra (*Mangifera indica*), Narang (*Citrus aurantium*)
	b) Kashayavarga	Bakul (*Minusops elengi*), Bilwa (*Aegle marmelos*)
4)	Tala varga	Draksha (*Vitis vinifera*), Mach (*Musa paradicaca*)
5)	Shak	Lashoon (*Alium sativum*), Palandu (*Allium cepa*)
6)	Pushp varga	Agastya (*Sesbania grandiflora*), Malati
7)	Udbhid	Palal, Dakshu, Karish, Sidaki
8)	Kanda varga	Sooran (*Amorphophalaus campanulatus*), Shatavari (*Asparagus racemosus)*
9)	Madya varga	Arisht (*Sapindus trifolus*), Drakshasava (Decoction of *Vitis vinifera*), Kharjur (*Phoenix sylvestris*), Dhanyamla

The plant biodiversity mentioned in Ayurvedic literature refers about medicinal plants, their methods of identification, propagation, preservation and utilization for preventing and curing human diseases.

d) Biodiversity enlisted by Europeans Portugese, Duch, Danish & English workers upto establishment of Botanical Survey of India.

After fifteenth century, the 'Biodiversity of India' was also **studied by Europeans** including Portugese, Duch, Danish and English workers who visited India for trade, tourism or other reasons. The following table shows names of foreign and some Indian workers, year of publication of their books or other contributions to the biodiversity of India.

Table 4 : Important workers & their contributions to Biodiversity of India.

Sr. No.	Name of the worker	Year	Contribution (Publication / Establishment of garden/society)	Specific study
1	Gasiya-De-Orta (Portuges)	1563	Coloquios Des Simples E Drogas De India	Medicinal plants
2	C-Acosta (Portuges)	1578	Tractado De Las Drogas	Indian plants
3	Henry Van Reed, Governer of Malbar (Dutch)	1683-1703	Hortus Malbarius (Published at Amstardam)	Plants of Malbar
4	Burman, J	1737	Thesaurus Zelanicus	Indian plants
5	George Everhard Rumph (Dutch)	1741-1755	Herbarium Amboinense	Indian plants
6	Burman Nicolus L.	1768	Flora Indica	Indian plants
7	John Jerord Quoaning (Danish)	1768	Established United Brothers Society at Trackbar	Indian Plants
8	Lt. Co. Robert Kid	1787	Established Botanical garden at Calcutta	Commercial plants
9	Roxburg, Superintendent of Botanical garden, Calcutta	1793	Published 3 books 1. Flora Indica 2. The plants of the coast of Coromondal 3. Hort's Bengalensis	Indian Plants Coromondal plants Bengal plants
10	Bookanan	1825	Prodomus Flora Nepalensis	Plants of Nepal and surrounding area
11	H. Piddington	1832	An English index to plants of India	Indian plants
12	Thomason Thomas	1855	Flora Indica	Indian plants
13	Wedom	1863	Ferns of Southern India	South India Ferns
		1865-1870	Ferns of British India	British India Ferns
		1869-1873	Flora Silvetika of the Madras presidency	Flora of Madras

Sr. No.	Name of the worker	Year	Contribution (Publication / Establishment of garden/society)	Specific study
14	Brandis D.	1874	The Forest Flora of the North-West and central India.	Forest flora
15	Dutt V.C.(Calcutta)	1877	Materia Medica of the Hindus	Medicinal plants
16	Mukharjee T.N.	1883	Amsterdam exhibition catalogue of Indian exhibits	Indian plants
17	Watt, G.	1889-1893	A dictionary of the economic products of India (6 vols.)	Economic plants.
18	Hooker J.D.	1875-1897	Flora of British India (7 Vols)	Indian plants
19	Botanical survey of India (B.S.I.)	1890	Established and published many research articles.	Indian plants

With the initiatives of the Botanical Survey of India (B.S.I.), the biodiversity of India is being studied from the various geographical regions of India.

(B) Biodiversity – Present Status :

'**The present studies**' on biodiversity of India are going at many National and State research institutes, Universities, colleges, departments, NGO's and other organizations located in various geographical and climatic zones of India which have documented the voluminous literature. The government is taking many efforts to protect the prestigious biodiversity of India through established 75 National parks, 42 Sanctuaries, 14 Biosphere reserves, 2 Hot Spots and many Botanical gardens, Zoos, Gene banks and Cryopreservations. The list of Biosphere reserves and hot spots of Biodiversity in India is given in the following tables.

Table 5 : Biosphere Reserves of India

Sr.No.	Name of Biosphere Reserve	Included States
1	Great Nicobar	Andaman and Nicobar
2	Gulf of Mannr	Tamil Nadu
3	Kanha	Madhya Pradesh
4	Kaziranga	Assam
5	Little Rann of Kachchh	Gujarat
6	Manas	Assam
7	Namdapha	Arunachal Pradesh
8	Nanda Devi	Uttar Pradesh
9	Nilgiri	Kerla, Karnataka and Tamil Nadu
10	Nokrek (Tura Range)	Meghalaya
11	North Island of Andamans	Andaman and Nicobar Island
12	Sundarbans	West Bengal
13	Thar Desert	Rajasthan
14	Uttarkhand (Valley of Flowers)	Uttar Pradesh

Table 6 : Hot spots of Biodiversity in India.

Sr. No.	Name of Hot spot	Geographical area	Climatic specialities	Important Biodiversity
1	Eastern Himalayan hot spot	From North Eastern India to Bhutan	Height of 1780-3500 meters and many deep valleys	Rich in some endemic plants e.g. Magnolia, Betula
2	Western Ghat hot spot	Karnataka, Maharashtrra and Kerala, Agasthamalai hills and silent valley	Height of 500 -1500 meters	Evergreen forests

(C) Biodiversity – Future Perspective:

The future perspective about the 'biodiversity of India' seems to be declining. The industrialization, urbanization and trading have resulted in extinction of important plant and animal species and many more have been accounted for threat categories in India as shown in the following table and figure.

Table 7 : Number of plant and animal species accounted for threat categories in India.

Sr. No.	Threatened species	Critically endangered	Endangered	Vulnerable	Lower risk
1	Angiosperms	51	19	16	14
2	Amphibians	48	22	14	16
3	Reptiles	43	21	15	21
4	Birds	36	17	09	38
5	Mammals	34	19	10	37

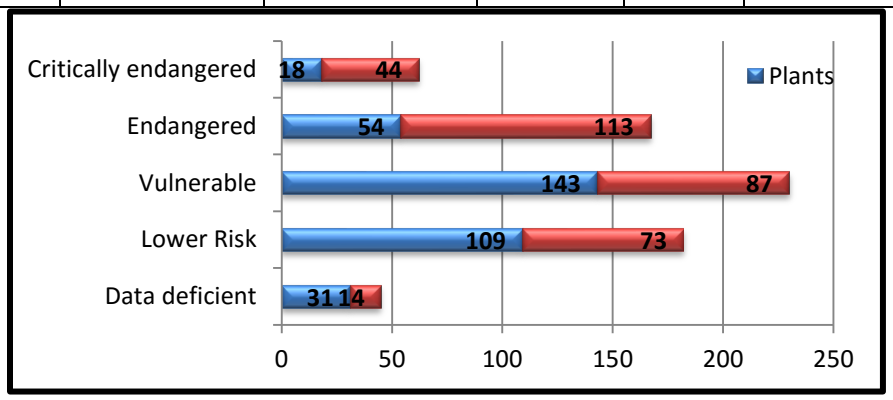

Fig. 1 : Number of plant and animal species accounted for threat categories in India.

It seems that the number of threatened species would be more **in future** due to increased urbanization, industrialization and trading in the globalized world. The only way to stop this is the shifting of human desire from **'Greed based'** to **'Need based'** ideology. This alone can only help to prevent the further destruction of this valuable wealth of India.

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