



RESEARCH ARTICLE

Panini's Astadhyayi in The Eyes of Plant Invasion on Indian Subcontinent

D. A. Patil

Post-Graduate Department of Botany,
S.S.V.P. Sanstha's L.K.Dr.P.R. Ghogrey Science College, Dhule-424005 (M.S.), India.
(*Former Professor & Principal)

*Corresponding Author: dapatil_10aug@yahoo.com

Manuscript Details

Manuscript Submitted : 14/06/2021
Manuscript Revised : 15/07/2021
Manuscript Accepted : 20/08/2021
Manuscript Published : 16/09/2021

Available On

<https://plantaescientia.com/ojs>

Cite This Article As

Patil D. A., (2021). Panini's Astadhyayi in the eyes of plant invasion on Indian Subcontinent. *Pla. Sci.* 2021; Vol. 04 Iss. 04 & 05:236-242.

Copyright



© The Author(s). 2021. Open Access
This article is distributed under the terms
of the Creative Commons Attribution
4.0 International License
<http://creativecommons.org/licenses/by/4.0/>

Indexed In

[CrossRef](#), [Scientific Indexing Services \(SIS\)](#), [Google Scholar](#), [Index Copernicus International \(ICI\)](#), [Directory of Research Journal Indexing \(DRJI\)](#), [CiteFactor](#), [Scientific Journal Impact Factor \(SJIF\)](#), [General Impact Factor](#), [Journal Factor](#), [Cosmos Impact Factor](#), [PKP Index](#), [AJIFACTOR Indexing](#), etc.

ABSTRACT

Indigenous plantlore is a manifestation in a given community, based on adaptation and wisdom of local people and environment. It develops over times and continues so also. This treasure of traditional knowledge is used to sustain the community and its bioculture. In long past, people of great understanding, christalized their wisdom in some treatises such as the Panini's Astadhyayi. This treatise is understood and well known for the genesis and development of Sanskrit knowledge. Ancient Sanskrit scripts usually contain information concerning culture and sustenance based on plant world. The present author analysed it in view of plant invasion on Indian landmass in Panini's time. Total 45 exotic plant species belonging to 44 genera and 29 angiospermic families are divulged from it. These belong to nearly all corners of the Old and New Worlds. Majority of them (28 species) are cultigens and still continue even in modern period in India. Of course, rest of them are wild, naturalised and presently constitute integral part of Indian biodiversity. The importance of such ancient treatises is dilated in this communication.

Keywords: Panini's Astadhyayi, Exotic Plants, Invasion, India

INTRODUCTION

Panini (520 BC-460 BC.) was a Sanskrit grammarian, philologist and a revered scholar in Ancient India. He was born in Shalatula, a town near to Attack on the Indus river in present day Pakistan. He is regarded the forerunner of the modern language theory. 'Astadhyayi' is a treatise composed by Panini. It consists of eight chapters (Ashta-eight). He gave about 4000 sutras (rules) and virtually built the whole structure of the Sanskrit language. This treatise contains many-sided data pertaining to social, literary, religious, political and geographical aspects of the ancient India. It is a reliable source of Indian history. This treatise sheds light itself on the life and thought of the population of ancient India. Obviously, life of the then Indians was interwoven with some elements of biodiversity. The present author, therefore, thought worth to throw light on plant species with particular emphasis on exotic ones which are indicative of plant introduction, naturalisation and ultimately plant invasion on the Indian subcontinent in Panini's time.

METHODOLOGY

The treatise by Panini and is available through the works of Sharma (1987) and Agrawal (1953). Information was borrowed and critically examined to tap down floral wealth contained in them. The Sanskrit plant names are equated carefully to the updated botanical names and families. The plant species were studied to know particularly their exotic status. Exotic status is ascertained by consulting relevant taxonomic literature mentioned against each species in the Table-I. The species are also analysed regarding cultivated status or wildness. The data accrued is discussed to reveal plant invasion in the then India.

RESULTS AND DISCUSSION

A large number of accounts on Indian biodiversity have been published in recent times inclusive of regional and local studies. While botanizing floristically, wild and naturalised exotic species are documented but exotic plants of agricultural, horticultural or ornamental significance are generally ignored. The exotic species form quite a good percentage in India (Maheshwari, 1960, 1979; Nayar, 1977; Reddy, 2008). Floristic studies, of late, are focussing on plant invasion in different regions in India. However, plant invasion and its history in ancient period have not received adequate attention. The present author made a headway in this direction (Patil, 2017a, b, 2018a, b; 2020). The present account is a similar attempt to focus a much-neglected ancient treatise which contains floral elements in Sanskrit form. These elements are deciphered with the help of relevant taxonomic literature and also ascertained for their exotic status.

Analysis of information accrued from the said treatise revealed total 45 angiospermic species belonging to 44 genera and 29 families. Of these, the dicotyledonous exotic species have major share in plant invasion in the erstwhile India (37 species, 39 genera, 27 families). The monocotyledonous ones have lesser contribution (08 species, 08 genera, 02 families). They belong to different habitat categories as trees (13), shrubs (04), climbers (07) and herbs (21).

The herbaceous species contributed significantly as compared to other categories. The figure in parenthesis denote number of exotic species. Interestingly, majority of exotics (28 species) are found under cultivation even in modern period. Wild ones have fair representation (15 species). There are two exotic species which are found wild as well as cultivated (Table-1). Plant species, particularly exotic ones, invade a geographical region for two reasons. First, they are introduced by mankind intentionally to add in their daily sustenance or sometimes to supplement their routine necessities. Secondly, plant species migrate naturally as they evolve and adapt certain morphological features to aid their dispersal to long distances. However, some species are also added by mankind due to his negligence while introducing cultivated plant species or trade and travel. Biotic and abiotic factors also play their role in plant dispersal in a region.

The Table-I indicated as many as 25 continents, geographical regions, islands or countries that contributed exotic species. Maximum exotic species are hailed from various parts of Old and New Worlds, in descending order, are: (i) Asia (Excl. India) (16), (ii) Africa (12), (iii) Europe (08), (iv) America (07) and (v) Mediterranean region (05). Some regions contributed as such: China (03), Persia (02) and Arabia (02). Many countries or regions shared just a single exotic species. These are Fertile Crescent, West Indies, Afghanistan, Baluchistan, Australia, Philippines, Middle East, Cochin China, Malay Islands, Madagascar, Brazil, Bali, East Indies, Paleotropics, Subtropics and warm temperate zone, Tropical and subtropical regions of both hemisphere.

An omnipresent role of plant world in various human societies world over needs no special mention. Plants have been a dominant source in food, medicine and miscellaneous human necessities. Plantlore in ancient times generally passed on by word-of-mouth as a tradition prior to the technologies and skills developed for writing. Gradually, primitive methods were developed e.g. writing on leaves or barks of plants. Historical records are testimony to such an evolution. Evolution of language is another arena which progressed eventually. Panini's Astadyayi is one such ancient Indian treatise which

crystalized the Sanskrit language in rule form and also contained information from nearly all compartments of knowledge and social practices prevalent in the time of Panini. Such evidences are rare and sporadic which pass on knowledge if analysed carefully and critically. The aforesaid information is restricted only to plant world. It is of help to understand economy, social needs and plant invasion on Indian subcontinent in the long past and hence should not be ignored. The information on plant species is still valuable. It informs Indian contacts and trade with other world, besides socio-cultural conditions and evolution of linguistics. It enriches our fund of data for our well-being.

ACKNOWLEDGEMENT

I am thankful to the authority of S.S.V.P. Sanstha, Dhule, for library facilities.

REFERENCES

- Agrawala, V. S. (1953) India As Known To Panini (A Study of The Cultural Material In The Ashtadhyayi). University of Lucknow, Lucknow, India.
- Almeida, M.R. (1996) Flora of Maharashtra Vol.I. Orient Press, Mumbai, Maharashtra, India.
- Bailey, L.H. (1949) Manual of Cultivated plants (Rev.Ed.) Macmillan, New York, USA.
- Bhandari, M.M. (1978) Flora of The Indian Desert. Scientific Publishers, Jodhpur, India.
- Chandra Sekar K. (2012) Invasive alien plants of Indian Himalayan region: Diversity and implication. American Journal of Plant Sciences. 3:177-184.
- Dar, G.H., Bhagat, R.C. and M.A.Khan (2002) Biodiversity of The Kashmir Himalaya, Valley Book House, Srinagar, India.
- De Candolle A. (1959) Origin of Cultivated Plants (Rev. 2nd Ed.) Hafner Publishing Co., London, UK.
- Debnath, A. and B. Debnath (2017) Diversity, invasion status and usages of alien plant species in North-Eastern Hilly State of Tripura: A Confluence of India-Barman Hotspot. American Journal of Plant Sciences 8:212-235.
- Gaikwad, S.P. and K.U. Garad (2015) Flora of Solapur (Maharashtra). Laxmi Book Publications, Solapur, Maharashtra, India.
- Graf, A.B. (1980) Exotica: Pictorial Cyclopeda of Exotic Plants From Tropical And Near-Tropic Regions. Roders Company INC., USA (10th Ed.)
- John Cameron (1891) Catalogue of Plants In The Botanical Garden, Bangalore And Its Vicinity (2nd Ed.). Mysore Government Central Press, Bangalore, India.
- Kaul, M.K. (1986) Weed Flora of Kashmir Valley. Scientific Publishers, Jodhpur, India.
- Kotresh, K. and M. Siddeshwari (2020) Alien flora of Ballari district, Karnataka, India. International Journal of Trend In Scientific Research And Development 5(1):167-173.
- Maheshwari, J.K. (1960) Studies on the naturalised flora of India. In: Proceedings of The Summer School of Botany (Ed.Maheshwari, P., Johri, B.M. and I.K.Vasil) pp.156-170.
- Maheshwari, J.K. (1979) Alien flora of India. In: Progress In Plant Research. Silver Jubilee Publication. NBRI. Vol.I (Ed.Khoshoo & Nair). pp.219-228.
- Martin, F.W., Campbell, C.W. and R.M. Ruberte (1987) Perennial Edible Fruits of The Tropics: An Inventory. U.S. Department of Agriculture. Agriculture Handbook No.642, 222 p.illus.
- Medakkar, S.S. and P.P. Sharma (2016) Some exotic plants in human consumption from Ahmednagar district, Maharashtra. International Journal of Current Research 8(7):35433-35436.
- Mingli, Tang, Pingping Zhang, Liyum Zhang, Minghao Li and Lifang Fu (2012) A potential bioenergy tree: Pistacia chinensis Bunge. Sciverse Science Direct Energy Procedia 16:737-746.
- Mukhopadhyay, D.P. and R.K.Chakraverty (2008) Plant Wealth of The Raj Bhavan, Kolkata. Occasional Paper-5 From Raj Bhavan, Kolkata, March, 2008.
- Naqshi, R.A. and G.N. Javeid (1987) Tribe Brassicaceae (Brassicaceae) in J And K State. J.Econ.Tax.Bot. 7:617-627.
- Nayar, M.P. (1977) Changing patterns of the Indian flora. Nelumbo 19(1-4):145-155.
- Panda T., Mishra N., Pradhan B.K. and R.B. Mohanty (2018) Expansive alien flora of Odisha, India. Journal of Agriculture And Environment For International Development 112(1):43-64.
- Panda, S. and A.P. Das (2004) Flora of Sambalpur (Orissa). Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Patil D.A. (1995) Exotic elements in the flora of Dhule district (Maharashtra-II). Biojournal 7(1-2):1-8.
- Patil, D.A. (2003) Flora of Dhule And Nandurbar District (Maharashtra). Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Patil, D.A. (2017a) Alien plant species recorded in Vedic and Post-Vedic period of India: An assessment. Sch.Acad.J.Biosci. 5(17):812-819.
- Patil, D.A. (2017b) Invasive alien species in Khandesh region (Maharashtra, India): Diversity, implications and measures. Sch.Acad.J.Biosci. 5(12):867-876.
- Patil, D.A. (2018a) Some comments on exotic floral elements as hailed from epic Ramayana. Sch.Acad.J.Biosci. 6(2):146-150.
- Patil, D.A. (2018b). On some alien plant species: Gleanings from Garuda Purana. Sch.Acad.J.Biosci. 6(2):163-166.
- Patil, D.A. (2019) Food Crops: Evolution, Diversity And Advances, Scientific Publishers, Jodhpur, India.
- Patil, D.A. (2020) Plant invasion: Some gleanings from Madhava Chikitsa. Plants and Environment 2(1):1-5.
- Pullaiah, T. and K. Sri. Ramamurthy (2001) Flora of Eastern Ghats. Vol.2. Regency Publications, New Delhi, India.
- Purseglove, J.W. (1968) Tropical Crops: Dicotyledons-2 Vols. Longmans, London, UK.
- Reddy, C. Sudhakar (2008) Catalogue of Invasive Alien Flora of India. Forestry And Ecology Division, National Remote Sensing Agency, Balanagar, Hyderabad-500037, India.
- Sharma, R.N. (1987) The Ashtadhyayi of Panini. Munshiram Manoharlal, New Delhi, India.
- Shetty, B.V. and V. Singh (1987) Flora of Rajasthan. Vol.I. Bot.Surv.India, Calcutta, India.

Singh A.K. and S.N.Nigam (2017) Ancient alien crop introductions integral to Indian agriculture: An overview. Proc.Indian Natn.Sci.Acad. 83(3):549-568.

Singh Th. B., Das, A.K. and P.K.Singh (2015). Study of alien and invasive flora of Valley District of Manipur and their control. International Journal For Innovative Research In Science & Technology 1(12):2349-601.

Singh, N.P., Karthikeyan, S., Lakshminarasimhan, P. and P.V.Prasanna (2000) Flora of Maharashtra State: Dicotyledones. Vol.I. Bot.Surv.India, Calcutta, India.

Singh, N.P., Lakshminarasimhan, P., Karthikeyan, S. and P.V.Prasanna (2001). Flora of Maharashtra State: Dicotyledones. Vol.II. Bot.Surv.India, Calcutta, India.

Singh, S.C. and G.N. Srivastava (2000) Exotic Medicinal plants of Lucknow district (U.P.) India. In: Ethnobotany And Medicinal Plant of Indian Subcontinent (Ed. Maheshwari, J.K.) Scientific Publishers, Jodhpur, India. pp.223-235.

Singh, V., Parmar, P.J. and R.P.Pandey (1991) Flora of Rajasthan. Vol.II. Bot.Surv.India, Calcutta, India.

Stewart R.R. (1972) An Annotated Catalogue of The Vascular Plants of West Pakistan And Kashmir. Fakhri Press, Karachi, Pakistan.

Titiek, S., Sari, N., Bahri, I.P. and G.T.Raharjo (2015) A Guide Book To Invasive Alien Plant Species In Indonesia: Research, Development And Innovation Agency, Ministry of Environment And Forests, Republic of Indonesia.

USDA-ARS (2014). Germplasm Resources Information Network (GRIN), Online Database, Beltsville, Maryland, USA: National Germplasm Resources Laboratory. <https://npgweb.ars-grin.gov/grianglobal/taxon/taxonomysimple.aspx>

Voight, J.O. (1845) Hortus Suburbans Calcuttensis, Bishop's College Press, Calcutta, India.

Yadav, S.R. and M.M.Sardesai (2002) Flora of Kolhapur District (Maharashtra). Shivaji University, Kolhapur, Maharashtra, India.

Table-I: Exotic Plant Species In Panini's Ashtadhyayi.

Sr. No.	Plant Species & Family	Sanskrit Name	Wild (W) /Cultivated (C)	Habit	Native Region or Country
1.	<i>Achyranthes aspera</i> L. Amaranthaceae	Pratyakpuspa	W	H	Tropics: Medakkar & Sharma, 2016.
2.	<i>Ailanthus excelsa</i> Roxb. Simaroubaceae	Aratu	W	T	America: Kotresh & Siddheshwari, 2020.
3.	<i>Albizia lebbek</i> (Linn.) Benth. Mimosaceae	Sirisha	C	T	Pantropical Africa & Tropical Asia: Bhandari, 1978.
4.	<i>Bauhinia variegata</i> L. Caesalpiniaceae	Kovidar	C	T	China: Debnath & Debnath, 2017; Pullaiah & Ramamurthy, 2001.
5.	<i>Boerhavia diffusa</i> Linn. Nyctaginaceae	Varsabhu	W	H	Tropical Africa: Panda, <i>et al.</i> , 2018.
6.	<i>Bombax ceiba</i> Linn. [Syn. <i>Salmalia malabarica</i> (DC.) Schott. & Endl.] Bombacaceae	Shalmali	W	T	America & Australia: Mukhopadhyay & Chakraborty, 2008.
7.	<i>Borassus flabellifer</i> L. Arecaceae	Tala, Tal	C	T	Tropical Africa: Reddy, 2008; Chandra Sekar, 2012.
8.	<i>Brassica campestris</i> Linn. var. <i>sarson</i> Prain Barassicaceae	Sarsap	C	H	Europe: Naqshi & Javeid, 1987.
9.	<i>Calotropis gigantea</i> (L.) R. Br. Asclepiadaceae	Prakpuspa	W	S	Tropical Africa: Reddy, 2008; Patil, 2017.
10.	<i>Calotropis procera</i> (Ait.) R. Br. Asclepiadaceae	Ark	W	S	Tropical Africa: Reddy, 2008; Patil, 2017.
11.	<i>Cannabis sativa</i> L. Cannabaceae	Bhanga	W,C	H.	Central Asia: Chandra Sekar, 2012. Asia (Excl.India): Kaul, 1986.
12.	<i>Carthamus tinctorius</i> Linn. Asteraceae	Maharjan	C	H	South-West Asia: Patil, 2003; Singh <i>et al.</i> , 2001.
13.	<i>Cassia fistula</i> L. Caesalpiniaceae	Vyadhighat	C	T	North America: Debnath & Debnath, 2017. Tropical Asia: Mukhopadhyay & Chakraverty, 2008.
14.	<i>Citrullus colocynthis</i> (Linn.) Schrad Cucurbitaceae	Gavadani	W	C	West Africa: Sainkhediya, 2016.
15.	<i>Citrus reticulata</i> Blanco Rutaceae	Narang	C	T	Philippines: Singhe <i>et al.</i> , 2000; Almeida, 1996. Asia (Excl. India): Stewart, 1972.
16.	<i>Coccinia grandis</i> (L.) Voight Cucurbitaceae	Bimbi	W,C	C	Africa: Titiek <i>et al.</i> , 2015; Medakkar & Sharma, 2016.
17.	<i>Coix lacryma-jobi</i> L. Poaceae	Gavedhuka	W	H	Tropical Asia: Singh <i>et al.</i> , 2015.
18.	<i>Coriandrum sativum</i> L. Apiaceae	Kustumburu	C	H	South Europe: Yadav & Sardesai, 2002. Mediterranean Region: Shetty & Singh, 1987.
19.	<i>Eleusine indica</i> (L.) Gaertn. Poaceae	Balvaja	W	H	Africa, Temperate & Tropical Asia: USDA-ARS, 2014.

20.	<i>Foeniculum vulgare</i> Mill. Apiaceae	Shatapuspa	C	H	South Europe: Gaikwad & Garad, 2015; Shetty & Singh, 1987. Mediterranean Region: Purselglove, 1968. Europe: Dar <i>et al.</i> , 2002.
21.	<i>Gossypium herbaceum</i> L. Malvaceae	Karpas	C	H	Arabia & Asia Minor: Bailey, 1949. Africa & Asia: Purselglove, 1968.
22.	<i>Hordeum vulgare</i> L. Poaceae	Yava, Yavak	C	H	Europe: Dar <i>et al.</i> , 2002.
23.	<i>Imparata cylindrica</i> (L.) Raeusch. Poaceae	Darbha	W	H	Tropical America: Debnath & Dabnath, 2017; Reddy, 2008. Asia (Excl. India) & Europe: Kaul, 1986. Tropical Asia: Titiek <i>et al.</i> , 2015.
24.	<i>Lagenaria siceraria</i> (Mol.) Standl. Cucurbitaceae	Pindophala	C	C	Africa: Singh & Nigam, 2017.
25.	<i>Lawsonia inermis</i> L. Lythraceae	Nakharanjani	C	S	Middle East: Gaikwad & Garad, 2015. Arabia & Persia: Shetty & Singh, 1987.
26.	<i>Lens culinaris</i> Medik. (Syn. <i>Ervum lens</i> L.) Papilionaceae	Masura	C	H	Mediterranean Region & West Asia: Shetty & Singh, 1987. Central Europe, Mediterranean Region & West Asia: Patil, 1995.
27.	<i>Linum utitatisima</i> L. Linaceae	Uma, Atasi	C	H	Mediterranean Region: De Candolle, 1959. Europe: Dar <i>et al.</i> , 2002.
28.	<i>Luffa acutangula</i> (Linn.) Roxb. Cucurbitaceae	Koshataki	C	C	Tropical Asia: John, 1891.
29.	<i>Macrotyloma uniflorum</i> (Lam.) Verdc. (Syn. <i>Dolichos biflorus</i> Auct. non L.; Syn. <i>D. uniflorus</i> Lam.) Papilionaceae	Kulattha	C	H	South-East Asia: Patil, 2019.
30.	<i>Moringa oleifera</i> Lam. Moringaceae	Shigru	C	T	America: Singh & Srivastava, 2000.
31.	<i>Nerium indicum</i> Mill. Apocynaceae	Karvir	C	S	Mediterranean Region: Singh <i>et al.</i> , 1991; Purselglove, 1968. China, Cochin China: Voight, 1845.
32.	<i>Panicum miliaceum</i> L. Poaceae	Anu	C	H	Asia (Excl. India): Kaul, 1986.
33.	<i>Phyllanthus acidus</i> (Linn.) Skeels [Syn. <i>Cicca acida</i> (Linn.) Meril] Euphorbiaceae	Lavani	C	T	Malay Islands & Madagascar: Singh <i>et al.</i> , 2001. North-East Brazil: Panda & Das, 2004.
34.	<i>Piper betle</i> Linn. Piperaceae	Tambul	C	C	Bali & East Indies: Graf, 1980.
35.	<i>Pistacia chinensis</i> Bunge Anacardiaceae	Shringi	C	T	China: Mingli Tang <i>et al.</i> , 2012.

36.	<i>Punica granatum</i> L. Punicaceae	Dadima	C	T	Afghanistan, Baluchistan & Persia: De Candolle, 1959; Patil, 2003; Shetty & Singh, 1987.
37.	<i>Rubia cordifolia</i> L. (Syn. <i>R.manjista</i>) Rubiaceae	Majuastha	W	C	Asia (Excl. India) & Africa: Kaul, 1986.
38.	<i>Saccharum spontaneum</i> L. Poaceae	Kasa	W	H	Tropical West Asia: Reddy, 2008; Patil, 2017.
39.	<i>Sesbania bispinosa</i> (Jacq.) W.F.Wight Papilionaceae	Itkat	W	H	Tropical America: Reddy, 2008; Patil, 2017.
40.	<i>Sida cordifolia</i> Linn. Malvaceae	Shvetapaki	W	H	Tropical & Subtropical Regions of Both Hemispheres: Bhandari, 1978.
41.	<i>Solanum virginianum</i> L. (Syn. <i>S.jacquinii</i> Miq.) Solanaceae	Kantakar	W	H	Paleotropical: Singh & Srivastava, 2000.
42.	<i>Tamarindus indica</i> Linn. Caesalpiniaceae	Tintidok	C	T	Tropical America: Shetty & Singh, 1987; Patil, 1990. Africa: Pullaiah & Ramamurthy, 2001; Panda & Das, 2004.
43.	<i>Triticum aestivum</i> L. Poaceae	Godhuma	C	H	Fertile Crescent: Singh & Nigam, 2017.
44.	<i>Vitis vinifera</i> L. Vitaceae	Draksha	C	C	South-East Europe To West Indies: Singh <i>et al.</i> , 2000. West Asia: Gaikwad & Garad, 2015.
45.	<i>Ziziphus jujuba</i> Mill. Rhamnaceae	Badara	C	T	Subtropics & Warm Temperate Zone: Martin <i>et al.</i> , 1987.