

Plant invasion: Some gleanings from Madhava Chikitsa

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Abstract: Medicolore is intimately rooted in ancient Sanskrit compendia in Ayurveda. Ayurveda during 5th-10th century AD in the Charak-Sushruta era became user-friendly. One such attempt is Madhava Chikitsa conceived and written by Madhacharya in 7th century. Of late, the scientific all-pervasive examination is being carried out. The present author studied it from the standpoint of plant invasion in erstwhile India. Total of 42 exotic plant species pertaining to 41 genera and 30 families of angiosperms have been documented from it. The majority of them (28 species) are under cultivation in India and rest others run wild on Indian landmass. Their nativity is also brought in a clearer focus. Maximum species appeared invaded from Europe (11 species), America (09 species), Africa and Asia (Excluding India) (06 species each), other countries, continents or regions are represented by one or two species each. The consequence of plant invasion is interpreted in Indian context. Our understanding can be enriched to suggest measures for conservation of nature if such introductions of plants revealed from ancient literary sources of India.

Keywords: Madhava Chikitsa, Exotics, Plant Invasion.

INTRODUCTION

A 7th century AD Indian physician Madhavacharya designed, conceived and wrote two treatises viz., Madhava Nidana and Madhava Chikitsa which dealt with human diseases, their causes, symptoms and remedial measures. His work is compiled on the foundations of knowledge resourced from earlier Samhita and Samgraha in Ayurveda. It still enjoys an independent respected and important treatise having unique content and written in its style. His formulations are thought original and based either on single drugs or in combinations. Madhava Chikitsa sheds more light on disease management and therapeutics, whereas Madhava Nidana dealt with medical diagnostics. The manuscript of Madhav Chikitsa remained unpublished and deposited in the Saraswati Library, Udaipur (Rajasthan, India) and recently published by Ayurveda Vishwa Bharati, Sardar Shahar (Rajasthan) in 1973. It is now also available with Bhandarkar Institute for Oriental Research, Pune (Maharashtra, India). Its importance has been unearthed, of late, (Sastry & Prasad, 2007; Mishra 2009; Krishnamurthy, 2012). Several translations in different languages in India and abroad are also now available. It has remained untouched from viewpoint of plant invasion on the Indian subcontinent as it also includes exotic plant species as sources of his formulations. Ancient scripts reflect human contacts, trade and ecological information of the said period or even earlier ones. The present author analysed the exotic floral content contained in it revealing plant invasion on the erstwhile Indian subcontinent.

METHODOLOGY

Madhava Chikitsa (Authored by Krishnamurthy 2012) in Sanskrit and English was consulted. This treatise explains original Sanskrit verses about medicinal recipes of plant origin. The plant species have Sanskrit names. They are verified for botanical identity consulting related literature (Chopra *et al.*, 1956; Sharma, 1956, 2003; Thakur & Chunekar, 1972; Sharma, 2001-2005; Khare, 2007). The nativity of each species is pointed out using relevant literary sources mentioned against each species as in table 1. Various floras mentioned in the references were also helpful while determining the plant species.

RESULTS

This study brought to light 42 exotic angiosperm species from the Madhava Chikitsa (Table 1). They belong to 41 genera and 30 families. Of these, 28 exotic species are generally cultivated, whereas 13 species occur in India as naturalised wild aliens. A single species viz., *Cassia fistula* L. found wild as well as planted in gardens as ornamental. All these species have been mentioned in the said manuscripts useful medicinally in ancient times especially before 7th century. They appear brought intentionally or unintentionally. The cultivated ones appear introduced for most sources of the food adjuncts and aromatics. The wild ones have now become an integral part of Indian biodiversity. The cultivated ones, as also the wild species have been appropriated by trial and errors and after experimentation as

medicinal sources by the Indian community in ancient times. The analysis of their nativity reveals that the maximum number of exotic species belongs to, in descending order, Europe (11 species), America (09 species), Africa (06 species) and Mediterranean region (04 species) and Afghanistan and China (03 species). Other countries represent either two species each e.g. Malaysia, Ceylon/Srilanka, and Indonesia. There are some countries that contributed a single species each such as Australia, Philippines, Persia, Pakistan, West Indies, Java, etc. These are indicative of a fact that the ancient Indians have contacts, whether direct or indirect, with the various parts of the world.

Table 1. Exotic plants divulged from ancient treatise Madhava Chikitsa.

S.N.	Scientific Name	Family	Sanskrit Name	Nativity
1	<i>Albizia lebbek</i> Benth.	Mimosaceae	Sirisa	Pantropical Africa & Tropical Asia (Bhandari, 1978)
2	<i>Allium sativum</i> L.	Liliaceae	Lasunah, Rasona	Europe (Gaikwad & Garad, 2015; Yadav & Sardesai, 2002)
3	<i>Amaranthus tricolor</i> L. *	Amaranthaceae	Ramasitalika	Asia (Excl. India) & Africa (Stewart, 1972) Tropical Asia (Yadav & Sardesai, 2002)
4	<i>Anethum graveolens</i> L. [= <i>A. sowa</i> Roxb. ex Flem.]	Apiaceae	Satahvaya	Europe (Yadav & Sardesai, 2002; Patil, 2003)
5	<i>Boerhavia diffusa</i> L. *	Nyctaginaceae	Punarnava	Tropical Africa (Panda <i>et al.</i> , 2018)
6	<i>Brassica campestris</i> L. var. <i>sarso</i> Prain	Brassicaceae	Saraeapa	Europe (Naqshi & Javeid, 1987)
7	<i>Carum carvi</i> L.	Apiaceae	Karavi	North & Central Europe (Patil & Dhale, 2013)
8	<i>Cassia fistula</i> L. **	Caesalpiniaceae	Sampaka	North America (Debnath & Debnath, 2017)
9	<i>Cinnamomum camphora</i> Nees & Eberm.	Lauraceae	Hima	China & Japan (Benthall, 1946)
10	<i>Cinnamomum zeylanicum</i> Blume [= <i>C. verum</i> Presl.]	Lauraceae	Travk	Ceylon (Sri Lanka) (John, 1891)
11	<i>Cissampelos pareira</i> L. var. <i>hirsuta</i> (Buch.-Ham. ex DC.) Forman *	Menispermaceae	Patha	South America (Rajagopal & Panigrahi, 1965; Pandu <i>et al.</i> , 2018)
12	<i>Coriandrum sativum</i> L.	Apiaceae	Dhanyaka	Mediterranean Region (Shetty & Singh, 1987)
13	<i>Cuminum cyminum</i> L.	Apiaceae	Svetajiraka	South Europe (Yadav & Sardesai, 2002) Mediterranean Region (Shetty & Singh, 1987)
14	<i>Cymbopogon citratus</i> (DC.) Stapf	Poaceae	Sugandhitrana	Malaysia & Ceylon (Purseglove, 1968)
15	<i>Cyperus rotundus</i> L. *	Cyperaceae	Musta	Europe (Kaul, 1986; Panda <i>et al.</i> , 2018) Tropical Africa (Debnath & Debnath, 2017)
16	<i>Eclipta prostrata</i> (L.) L. [= <i>E. alba</i> Hassk.] *	Asteraceae	Bhringaraja	South & Tropical America (ChandraSekar, 2012; Patil, 2017; Reddy, 2008)
17	<i>Ferula assafoetida</i> Regel	Apiaceae	Hingu	Central Asia, Eastern Iran to Afghanistan (Mahendra & Bisht, 2012)
18	<i>Fumaria indica</i> (Haussk.) Pugsley*	Fumariaceae	Parpaka	Pakistan & Afghanistan (Negi & Hajra, 2007)
19	<i>Glycyrrhiza glabra</i> L.	Papilionaceae	Madhukam	Eurasia, Northern Africa & Western Asia (Ali Al-Snafi, 2018)
20	<i>Hordeum vulgare</i> L.	Poaceae	Yava	Europe & North America (Dar <i>et al.</i> , 2002)

21	<i>Lens culinaris</i> Medic.	Papilionaceae	Masura	Central Europe, Mediterranean Region & West Asia (Patil, 1995)
22	<i>Luffa acutangula</i> (L.) Roxb.	Cucurbitaceae	Krtavedhana	Tropical Asia (John, 1891)
23	<i>Melia azaderach</i> L.	Meliaceae	Mahiniba	Asia (Excl. India) (Ara <i>et al.</i> , 1995)
24	<i>Mimosa pudica</i> L.	Mimosaceae	Krtanjali	Brazil (Shetty & Singh, 1987)
25	<i>Mucuna pruriens</i> (L.) DC.	Papilionaceae	Vanari	America (Singh & Nigam, 2017)
26	<i>Oxalis corniculata</i> L. *	Oxalidaceae	Cangeri	Europe (Reddy, 2008; ChandraSekar, 2012) North America (Babu, 1977)
27	<i>Peristrophe paniculata</i> (Forssk.) Brummit * [= <i>P. bicalyculata</i> (Retz.) Nees]	Acanthaceae	Kakajangha	Tropical America (Reddy, 2008; Patil, 2017; ChandraSekar, 2012)
28	<i>Piper retrofractum</i> Vahl. [= <i>P. chaba</i> Hunter]	Piperaceae	Gajahva	Native of Southern China, Malaysia, Indonesia, Philippines & Indo-China (Tropical Plant Database 2019)
29	<i>Pistacia chinensis</i> Bunge.	Anacardiaceae	Karkaoa	China (Tang <i>et al.</i> , 2012)
30	<i>Plectranthus scutellaroides</i> (L.) R.Br. [= <i>Coleus scutellaroides</i> (L.) Benth.]	Lamiaceae	Udicya	Java (Yadav & Sardesai, 2002)
31	<i>Plumbeago zeylanica</i> L. *	Plumbaginaceae	Vahni	Tropics of Asia, Africa, Australia & Hawaii (Bailey, 1930) Africa (Rajagopal & Panigrahi, 1965)
32	<i>Punica granatum</i> L.	Punicaceae	Dadima	Afghanistan, Baluchistan & Persia (Shetty & Singh, 1987; Patil, 2003) South Asia (Gaikwad & Garad, 2015)
33	<i>Ricinus communis</i> L.	Euphorbiaceae	Eranda	Tropical Africa (Yadav & Sardesai, 2002) Africa (Stewart, 1972)
34	<i>Rubia cordifolia</i> L.	Rubiaceae	Manjistha	Asia (Excl. India) & Africa (Kaul, 1986)
35	<i>Sesbania grandiflora</i> Pers.	Papilionaceae	Muni	Indonesia (Patil, 1995)
36	<i>Sida cordifolia</i> L. *	Malvaceae	Bala	Tropical & Subtropical Regions of both Hemispheres (Bhandari, 1978)
37	<i>Trachyspermum ammi</i> (L.) Sprague [= <i>T. natans</i> L. var. <i>bispirosa</i> Roxb.]	Apiaceae	Yavani	South Europe (Yadav & Sardesai, 2002; Gaikwad & Garad, 2015) Africa (Shetty & Singh, 1987)
38	<i>Trapa bispinosa</i> Roxb.	Trapaceae	Srigataka	Europe (Kak, 1990)
39	<i>Tribulus terrestris</i> L. *	Zygophyllaceae	Gokaeura	Tropical America (ChandraSekar, 2012; Reddy, 2008) Africa & Asia (Excl. India) (Kaul, 1986)
40	<i>Vernonia cinerea</i> Less. *	Asteraceae	Sahadevi	South America (Debnath & Debnath 2017)
41	<i>Vitis vinifera</i> L.	Vitaceae	Draksa	South-East Europe To West Indies (Singh <i>et al.</i> , 2000) Asia (Excl. India) & Europe (Stewart, 1972)

42	<i>Ziziphus jujuba</i> Mill.	Rhamnaceae	Kola	Subtropics & Warm Temperate Zone (Martin <i>et al.</i> , 1987)
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Note: *= Exclusively wild; **= Wild & Cultivated.

DISCUSSION

There is a recent trend to unearth plantlore from the ancient Indian Literature. Katti (1991), Krishnamurthy (1996) and Amirthalingam & Sudhakar (2013) revealed plant and animal diversity in Valmiki's Ramayana. Mahendale (1986) studied floral elements contained in Aranyakaparvan of Mahabharata. Patil (2017) investigated ancient Vedic and Post-Vedic literature in view of plant invasion. These ancient monumental works inform on biodiversity prevailing in those periods. The diversity of nature has always fascinated mankind since the ancient times. The glory, beauty and utility of the biodiversity elements is integrated in the ancient scripts written by ancient Indian sages, philosophers and writers. They had commendable knowledge of the plant kingdom of their land and time which is reflected in their works. The present author also examined Madhava Chikitsa, a 7th centurian manuscript commenting on medicinal utilities borrowed partly the past ancient Sanskrit literature and epitomes with his own experience and knowledge about medicinal plant species. He mentioned several plants, indigenous or exotic ones. However, these floral elements are not focused earlier from the point of biological invasion on Indian landmass. The present study made an inquiry into them, the results of this investigation are presented in this communication.

The plant species added or cultivated have a positive impact on the economy and lifestyle of the people being an addition or new utilitarian sources. However, other wild taxa invaded in India have been also found useful medicinally. Some of them are, however, invasive aliens *e.g.* *Cyperus rotundus* L., *Eclipta prostrata* (L.) L., *Peristrophe paniculata* (Forssk.) Brummit, *Vernonia cineraria* Less., etc. Convention for Biological Diversity (1992) considered biological invasion of alien species as the second worst threat after habitat destruction.

CONCLUSIONS

After successful local establishment, such invasive alien species disperse and produce variable seeds, propagules or offsprings in areas distant from the sites of introduction. Many times, they are ready colonizers in disturbed areas and cause considerable damage ecologically. They are also responsible for the disappearance of threatened and endemic species. They reduce the carrying capacity of pastures and increase the maintenance costs of croplands. The plant world and the human world act and react with each other in different ways, positively or negatively. Conservation of nature, preservation of ecological equilibrium and the protection of the environment have become a watchword in recent time. These concepts emerged out of our better understanding of nature. Our understanding on this line can be enriched more if we unearth knowledge of the ancient people embodied in such manuscripts such as Madhava Chikitsa.

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