INDISCRIMINATE PLANTATION OF *JATROPHA CURCUS* IN INDIA IS A HARMFUL PRACTICE FROM AN ECOLOGICAL VIEWPOINT IN LONG RUN

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Indiscriminate plantation of exotic flora *Jatropha curcus* for sheer economic gain is a suicidal exercise as this hardy plant species may turn itself to a noxious weed in future causing heavy loss to the biological diversity.

Introduction

Indiscriminate plantation of hardy exotic plant species *Jatropha curcus* merely for the sake of economic benefits may pose serious ecological problems in the country in future. Several exotic flora either introduced accidentally or intentionally are already causing serious ecological problems, meanwhile the large scale plantation of this plant species may substantially add to the ecological deterioration of the country. The loss of biological diversity, habitat fragmentation and depletion of soil nutrients are the major ecological problems caused by the exotic flora. About 40% of the plant species found in India are exotic. The exotic species are the second greatest threat to the biodiversity after direct habitat destruction. Therefore, they are often referred to as ‘biological pollutants’ due to their destructive effects on natural and agro-ecosystems. Non-native plant species have become component of the flora of most regions of the world within the last 500 years as result of the tremendous species exchange between the continents and vegetation transformation by human beings. The exotic flora are considered as a major threat to biological diversity. Serious ecological effects of fast spreading hardy exotics have been well established. The one-fourth of the introduced species in India becomes proving fatal within 50-100 years. According to an estimate the loss caused by exotics in India costs about Rs.6 thousand billion.

*J. curcus* is a much highlighted plant today as recent researches have proven that its formulated seed soil can be used as alternative of diesel. Therefore in oil deficient country India, this plant species is projected as a ‘miracle plant’. It is considered as panacea for all problems. However, without considering pros and cons of its cultivation, the Central Government as well as the state Governments and Non Government Organizations are giving special emphasis by motivating farmers for the large scale plantation on private lands. Indian Railway has already proposed to raise plantations of *J. curcus* along the railway tracks so that the bio-diesel obtained can be used as fuel for rail engines. The commercial agriculture of this plant species on large scale is under way in several states of India. However, Chhattisgarh tops in plantation of *J. curcus*. In this tribal dominant state currently 20 to 25 crores plants of *J. curcus* are being planted annually under bio-diesel mission programme. Due to its hardy nature and economic significance it has become favourite choice of forest department. It is gradually becoming the most preferred species for the afforestation of public lands and...
wastelands. The plant is also being planted for the restoration of degraded forests.

**Characteristics and Economic Importance of *Jatropha curcus***

*Jatropha curcus* Linn. (Physic nut or Purging nut) is a tropical soft wooded evergreen shrub introduced from Tropical America\(^\text{10}\). Vernacularly the plant is known as *Ratanjyot* and *Safed arand* in India. It belongs to the family Euphorbiaceae. The plant attains maximum height of 5 m. It is a cross pollinated plant in which flowering occurs by the end of the second year. The flowers appear in the month of September-October. Fruits are green in colour, which become black after ripening. Each fruit comprises 3-4 seeds. Its economic life is up to 40 years. *J. curcus* is supposed to existing in India from several decades. Occurrence of this species in India has been mentioned in the Hooker’s Flora of India (1875)\(^\text{11}\). In Southern India it has been grown as border plant along the fences.

The *J. curcus* is an extremely hardy plant species capable of growing on any type of soil. This fast growing plant has no natural enemy in India and is also avoided by grazing herbivores. *J. curcus* has a shorter gestation period and has prolific breeding potential. It possesses regeneration power through vegetative parts left in the soil. It has the tendency to monopolize the habitat where it grows.

The plant is known for its non-edible thick seed oil (40%), which besides having medicinal attributes (used for the treatment of the skin diseases like eczema, herpes, sores etc.) is used as an illuminant\(^\text{10}\) and for making soaps and candles. The formulated seed oil through esterification can be used as alternative of diesel. Hence *J. curcus* is known as ‘Bio-diesel plant’.

The plant species also finds its several applications in indigenous system of disease treatment. The fresh latex of the plant is styptic, hence it is applied to bleeding wounds. The latex is locally applied to piles, scabies, eczema, ringworm, itch and decayed teeth\(^\text{12}\). Roasted seeds are used as a purgative. A decoction of leaves is a febrifuge and mouth wash for strengthening the gums. A warm poultice of the leaves is a galactagogue, it is applied to the breast of nursing mothers.

**Harmful Exotic Flora of India**

Several exotic flora either introduced deliberately or accidentally have serious ecological impacts in India. For instance, the evergreen hardy *Eucalyptus globulus* and *Eucalyptus teretecornis* were introduced to India in 1790 and 1852, respectively. However, their indiscriminate plantations for economic gain in 19\(^\text{th}\) and 20\(^\text{th}\) century had led to ecological problems. *Eucalyptus* is frequently reported to deplete soil of its nutrient reserve and inhibits undergrowth because of allelopathic effects\(^\text{13,14}\). It also depletes the sub-soil water reserve thus lowering the ground water table. Consequently the plantation of *Eucalyptus* has been totally banned now by branding it as “Ecological Terrorist”. The *Eucalyptus* is native of Australia and belongs to family Myrtaceae.

The *Prosopis juliflora* syn. *Prosopis chilensis* (Mesquite) is another deliberately introduced hardy small tree species native to Tropical America. It belongs to family Fabaceae. Due to its hardy nature it was planted on large scale in arid and semi-arid regions of India. However, in the state of Gujarat it has turned itself to a noxious weed causing habitat destruction and the replacement of indigenous flora. Banni region of Kutch in Gujarat, which was once considered to be Asia’s biggest grassland, has been destroyed due to infestation by this exotic flora. This deep-rooted plant species also depletes sub-soil water. It was introduced in Sindh Province of united India in 1878. This plant species is gradually emerging as weed in Singrauli coalfields, where it is being used for the revegetation of coal mine spoils\(^\text{15}\).

The fast growing tree species *Leucaena leucocephala* (White popinae) native to Central America, which also belongs to family Fabaceae is gradually posing threat to biological diversity\(^\text{16}\). The self-sown seedlings of this tree species did not allow the other plant species to flourish in its vicinity thus causing the replacement of native species\(^\text{17}\). In India, the tree species is generally planted for shade, ornamentation, timber and fuel-wood and also for forage which is highly palatable, digestive and nutritious. This tree species was introduced to India in 19\(^\text{th}\) century. Today this tree species has spread to 21 states and 2 union territories in India.

The hardy *Acacia nilotica* introduced to India in the beginning of 19\(^\text{th}\) century from Australia, today has occupied more than 20 thousand hectares of land area in several states of the country. Due to its stubborn nature the plant species rapidly establishes its colonies. Moreover, due to its superior competitive ability the native species are eliminated. *A. nilotica* also belongs to family Fabaceae.

The *Lantana camara* is another exotic perennial shrub native to Tropical America which belongs to family Verbenaceae. It was introduced intentionally to India via Sri Lanka in 1809 as an ornamental plant. This hardy plant
species had escaped the captivity of human cultivation as ornamental plant and turned itself to a harmful flora in India. The plant is spreading fast now covering almost all types of lands, e.g. forests, agricultural lands, grasslands and even wastelands. In mountain, L. camara has been seen one of the most invasive weed with serious implications on biodiversity and major threats to habitat destruction leading to mass extinction of species\textsuperscript{18}. This exotic flora is emerging as a serious threat to the biodiversity of the forests of Vindhyan region.

The \textit{Eichhornia crassipes} (Water hyacinth) introduced intentionally as ornamental plant by Britishers in the 19\textsuperscript{th} century had emerged as a problematic flora for the country. It belongs to family Pontederiaceae. The \textit{E. crassipes} is native of Central and South America. It is an aquatic flora nick named as “Terror of Bengal”, “Curse of Bengal”, “Blue Devil” etc. due to its devastating effects. It infests the fresh water bodies like rivers, ponds, lakes, canals etc. thus interfering with fishing, irrigation and navigation. Besides this, the plant depletes the biodiversity of fresh water bodies. Furthermore, this ornamental plant turn weed even infests the water logged paddy fields affecting the productivity of paddy crop. This aquatic plant has emerged as a serious menace in state of West Bengal, Bihar and Andhra Pradesh.

A well known herbaceous exotic flora, \textit{Parthenium hysterophorus} (carrot weed or congress grass) belonging to family Asteraceae is posing serious threat to biological diversity in the Plains of India. This robust weed has allelopathic property, which suppresses the flora growing in its vicinity and consequently causes the replacement of native plant species. In addition to this, the plant has become serious health hazard to human and livestock population. It was accidentally introduced to India in 1810\textsuperscript{19}. Today this flora has spread to various parts of the country. It is also native of Tropical America where it is known as ‘White top’ and ‘Rag weed’.

The herbaceous exotic flora \textit{Eupatorium adenophorum} and \textit{Eupatorium riparium} are depleting the biodiversity at rapid rate on higher altitudes of Meghalaya. The \textit{Eupatorium odoratum}, which is a fast growing much branched shrub nick named as ‘communist weed” is another problematic flora. It has spread to agricultural lands also and the leguminous cover crop loses in competition with this exotic weed. It comes up in abundance in fallow lands, road sides, nurseries and forest areas freshly cleared for plantation and such other open situation. It is common in the state of Kerala. The above mentioned three flora are native of Central and South America and belongs to family Asteraceae.

The \textit{Mikania micrantha}, \textit{Ageratum conyzoides} and \textit{Galinsoga parvifolia} are the other exotic flora posing threat to biological diversity of India. All three are herbaceous flora belonging to family Asteraceae. The \textit{A. conyzoides} is native of Tropical America while \textit{M. micrantha} and \textit{G. parvifolia} are native of Central and South America.

\textbf{Why Jatropha curcus can become Harmful Flora in Future?}

Question can be raised that if \textit{J. curcus} exists from several decades in India without any sign of harmful effects then how it can become harmful in future. In fact, earlier the bio-diesel yielding property was not known therefore its plantation was not indiscriminate as it is today. There are instances to prove it. \textit{E. globulus} and \textit{E. teretecornis} were introduced to India in 1790 and 1852, respectively but their indiscriminate plantation for economic benefits and also for ornamentation and shade in 19\textsuperscript{th} and 20\textsuperscript{th} century had led to the revelation of its side effects in the second half of 20\textsuperscript{th} century. Similarly \textit{P. juliflora} was introduced to India in 1878 but its indiscriminate plantation in arid and semi-arid areas to stabilize the shifting sand dunes and to fulfill the need of fodder, fuel and timber in 20\textsuperscript{th} century had revealed its devastating effects. So plantations of hardy exotics in a limit would keep their population in control. However, their indiscriminate plantation / cultivation could turn them into problematic flora as their natural enemies are not found outside their native place.

Plantation of \textit{J. curcus} in forests of India is a matter of serious concern, as this hardy and aggressive plant species can eliminate the native species. Plantations of \textit{Eucalyptus} spp. and \textit{Acacia auriculiformis} (Australian babool) have replaced the mixed \textit{Shola} forests in South India\textsuperscript{20}.

\textbf{Indian Options of Jatropha curcus}

A multipurpose native evergreen tree species \textit{Pongamia pinnata} syn. \textit{Pongamia glabra} (Pongam tree) vernacularly known as Karanja could prove a good alternative of \textit{J. curcus}. It is a fast growing, medium sized glabrous tree belonging to family Fabaceae. Tree produces short bole with a spreading crown and drooping branches. It is found on several types of soils along the stream and river banks or near the sea coast and tidal forests\textsuperscript{21}. It is the constituent species of the tidal forests. It is also planted along roadside. The seed oil of the \textit{P. pinnata} is chemically similar to that of \textit{J. curcus}. Hence the formulated oil through trans-esterification can be used as alternative...
of diesel. The oil possesses insecticidal and antibacterial properties. The oil is traditionally used in the treatment of skin diseases and rheumatism\(^\text{10,12}\). The seed oil of the \(P.\ pinnata\) is used as illuminant. The oil cake is used as concentrated organic manure. The hardy \(P.\ pinnata\) tree can easily be grown on wastelands. Thus it is useful in the reclamation of wastelands. It is the most suitable tree species for the restoration of saline and alkaline lands as well as the mine spoils. Being a nitrogen fixing plant species the leaves are rich in nitrogen (about 3-4\%) and are used as green manure. The leaves are also used as fodder to feed livestock population. The wood which is yellowish white is not durable hence used for agricultural implements. The wood is also used as fuel.

In addition to \(P.\ pinnata\), another evergreen native tree species \(Calophyllum\ inophyllum\) (Indian Laurel) vernacularly known as \(Surpan\) and \(Sultan\ champa\) could also serve as an alternative of \(J.\ curcus\). This tree species is found in South India and Andman Islands. It belongs to family Clausiaceae (Guttiferae). The seed oil is chemically closer to that of \(J.\ curcus\). Hence the formulated seed oil of \(C.\ inophyllum\) could also be used as alternative of diesel. The seed oil is traditionally used as illuminant and in treatment of rheumatism\(^\text{12}\). The oil is also used in the making of soaps.

**Conclusion**

Thus on account of the adverse ecological impacts of exotic flora on natural and man-managed ecosystems in India, indiscriminate plantation of \(J.\ curcus\) is indeed an unfair practice which needs to be avoided. In addition to this, in mega-diversity country India it is the need of the hour to search the alternatives of \(J.\ curcus\) in native flora to rule out any probable adverse effects of this exotic flora on ecology and environment of the country.

**References**

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