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# Studies on *Parkia timoriana* (DC.) Merr: An endemic & economically important tree species of north east India

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### Abstract

*Parkia timoriana* (DC.) Merr. is highly underutilized leguminous tree with multidimensional utility and benefits. It is found in northeastern Indian states having tremendous ethno-botanical and economic potential for ethnic people of the region. Right from flowers and tender pods to mature seeds every part of the plant are edible, provide a good source of nutrients and fetch high market price during growing seasons. Despite the fact that, it has high commercial importance, the research and knowledge on this wonder plant is scanty and its distribution and utilization for human consumption has not yet been fully exploited. Thus, present study examined the geographical distribution range of the *P. timoriana* (DC.) Merr. in North-east India and highlights its botany, reproductive biology, propagation through alternative means, physiochemical and ethno botanical utility & exploring its economical potential during Covid-19 pandemic period among the native tribes of northeast India.

**Keywords:** Distribution, ethnobotany, economic potential, *P. timoriana*, reproductive biology

### Introduction

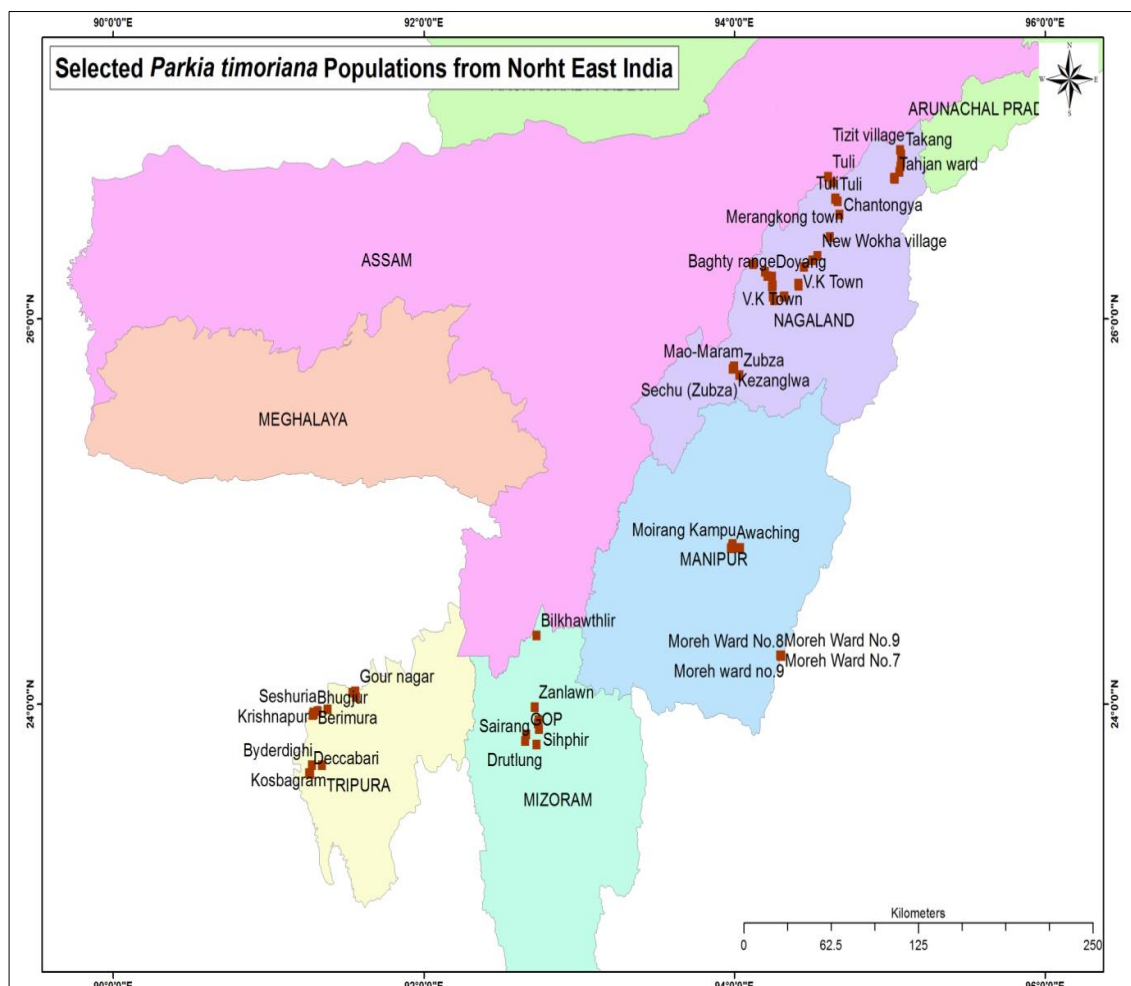
*Parkia timoriana* (DC.) Merr. Syn. *P. roxburghii* G. Don from Fabaceae family (subfamily Mimosoideae tribe Mimoseae) commonly known as tree bean is an important tree legume of old world tropics. The name was derived after Mungo Park (1771-1805), a well known Scottish explorer of West Africa. Out of the twelve known species of *Parkia* found in Indo-Pacific region, *P. timoriana* is most prevalent species in Southeast Asian countries viz. India, Bangladesh, Myanmar, Java, Thailand, Egypt and the Malaysian region (Hopkins 1994)<sup>[7]</sup>. In India, it is confined to North eastern states (i.e. Mizoram, Nagaland, Manipur, Meghalaya and Assam) in evergreen primary and disturbed rain forest, moist mixed deciduous forest and dry evergreen forest, at an altitudinal range of 0-600 m asl (Kanjilal *et al.* 1938)<sup>[10]</sup>. It is locally known as 'Yongchak' in north-east India, 'Petai' in Indonesia, Malaysia and 'sator' in Thailand.

Tree bean flourishes well in sandy, loam, podzolic soil and in close proximity of river banks (Lim TK, 2012; Thangjam, 2014)<sup>[11, 23]</sup>. The most favorable temperature required for its proliferation is 24 °C. It is generally found growing under semi-wild condition or in homestead backyard gardens. *Parkia* tree is a popular non-conventional source of dietary, therapeutic and recreational values among the ethnic communities of Eastern Himalayan region of India. Its immature tender pods and seeds have unique taste and flavour which are consumed during developmental stages by the local people. In North East India, it is considered as highly pride and costly vegetable, fetching Rs 50-70/- per pod during off-season and Rs. 15- 20/- per pod during peak season (Roy *et al.* 2016)<sup>[17]</sup>. However, in the recent past, tree bean plants are under severe threat in North East India. Unsustainable harvesting, insect-pest infestation, climatic disruption, mobile radiations and various other threats have resulted a vast population decline as well as poor natural regeneration in the wild (Firake *et al.* 2013; Thangjam *et al.* 2003a)<sup>[6, 24]</sup>. Moreover, lack of organized plantation has created demand-supply imbalance of tree bean in North Eastern States. Hence to fill this shortfall, considerable volume of tree bean is being imported from neighboring country Myanmar. Keeping in view the intimidation and significance of *Parkia* as a livelihood source of people, sincere efforts are needed to conserve this tree species for long term survival.

## Materials and Methods

In view of the above facts, Rain Forest Research Institute (RFRI), Jorhat is undertaking extensive field surveys in Eastern Himalayan region where *Parkia* population is declining and at the same time efforts are also being made to explore healthy population for germplasm collection and conservation. During the survey, information on morpho-physiological characters of *Parkia* trees and physiographical

features of each location were recorded. The superior populations of *Parkia* having, tall, healthy, prolific fruit bearing trees were selected based on scoring scale consisting of different morphological parameters i.e height, girth, number of branches, number of pods per bunch, pod length, seeds per pod, seed size and weight etc. The selected phenotypes were considered for further phenological studies and propagation material.



**Fig 1:** Population of *P. timoriana* selected form different growing region of North East India.

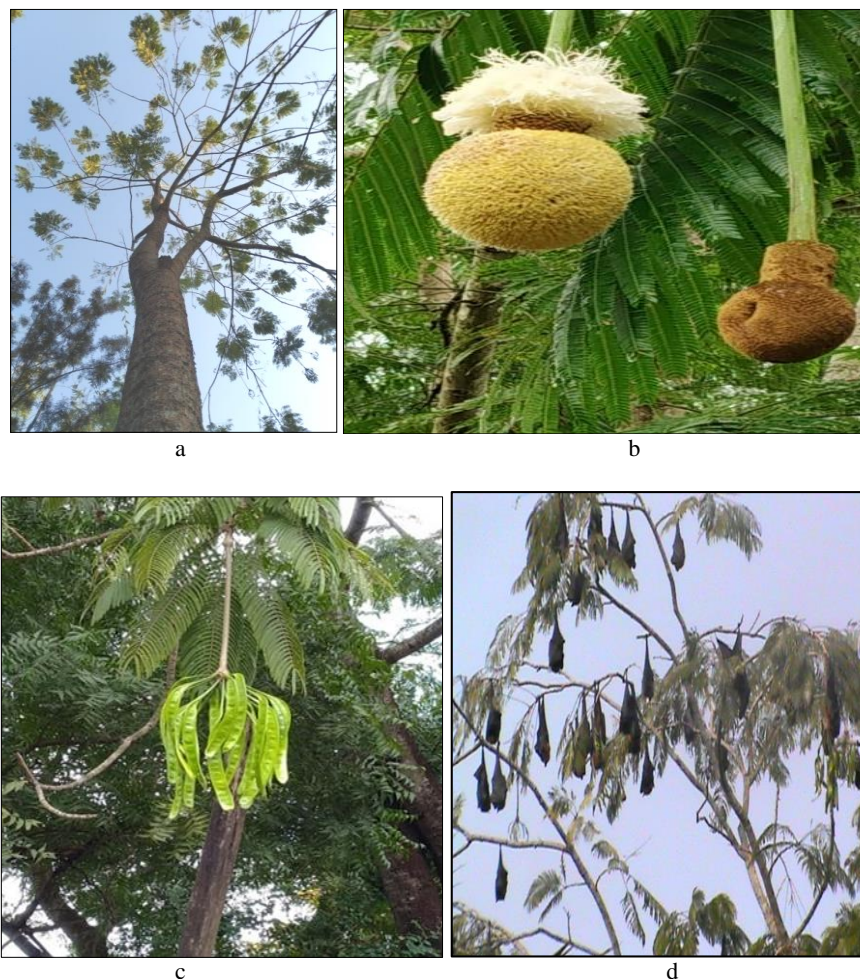
## Botanical description

Taxonomically, the accepted name of tree bean is “*Parkia timoriana* (DC.) Merr.” However, it has several other synonyms such as *Parkia roxburghii* G. Don, *Acacia niopo* Litv. Inga timoriana DC., *Mimosa peregrine* Blanco, *Parkia calcarata* Lecomte and *Parkia grandis* Hassk (<http://www.theplantlist.org/tpl1.1/record/ild-24964>) [8]. In Indo-Pacific region *P. timoriana* is the most prevalent species which is somewhat similar to *P. biglandulosa* and *P. speciosa* found in the same region but, distinguished from former by broader, rather sigmoid, not linear leaflets and later by having acute, not rounded apex of leaflets and lack of pubescence on outer side of corolla lobes (Hopkins 1994) [7].

In the present study, it was observed that the average height and canopy diameter of mature *Parkia timoriana* trees was 20-25 m and 15-20 m respectively. The leaves are alternate, compound-bipinnate, having 18-42 cm long petiole bearing 14-31 pairs of opposite to subopposite pinnae and each pinna bears 52-72 pairs of 6-10.5 × 1-2 mm sigmoid leaflet (Fig. 2a). *P. timoriana* shows annual phenological cycle with short phase of leaflessness followed by a flush of new light green

shiny leaves.

In north east India *Parkia* flowering starts from September onwards and remains till October. The trees bear several tiny yellowish flowers clustered into racemose type pendent capitula, hanging at the top of long stalks from tree branches. Capitula are 5.5-6.7 cm long, somewhat biglobose at anthesis, with apical fertile elliptical part having 3.1 -4.5 cm diameter, central constricted nectar-secreting area 2.1-2.5 cm diameter and short basal staminodial region of 3 cm diameter (Fig. 2b). The hermaphrodite flowers of the capitulum bear five calyx lobes partially gamosepalous and petaloid persisting in the flower. Five membranous polypetalous corolla lobes found attached to the stamina tube about 2–2.5 mm above the calyx. Androecium represented by 10 whitish stamens which are fuse at the base to form Staminal tube while Gynoecium is represented by single stigma, style and simple ovary having marginal placentation (Hopkins 1994) [7]. The fruit is a long, flattened legume pod up to 36 centimeters long which contains up to 21 hard, black seeds each around 2 centimeters long (Fig. 2c)



**Figure 2.** *Parkia timoriana* (a) Tree canopy, (b) yellowish ball like mature & brown greenish juvenile capitula, (c) bunch of tender pods hanging on the tree, (d) Dusk Bats visiting *Parkia* tree in Krishnapur village, West Tripura (Photo by RFRI team)

## Results

### Reproductive biology and Phenology

During our current survey in north East India, it was observed that bats are the exclusive fruit and flower-feeders and acts as principal pollinator in *Parkia* trees. They are attracted towards foetid and fruity scent of fertile flowers during night and upon landing on capitulum, it gets dusted with pollen which indicates that bats are the vector for pollination (Fig. 2d). However, non-restrictive nature of the capitulum may suggest pollination by other means which could also happen through nocturnal moths, honey bees, spiders and parakeet etc.

Fruit setting starts 10-15 days after the flowering and pods are emerge in bunches of 20-30 or even more, pendent from a single swollen receptacle. Initially the pods are soft, tender and bright green in colour, about 25 -30 cm long and 1.5 to 4.5 cm in width during December to January. Upon maturation in the month of March-April only 10-15 pods per bunch remains intact having an average length of 35-40 cm and breadth 5-7 cm. The size of pods determines the number and dimension of seeds. At maturity, pods turn black and contain yellow dry powdery pulp in which 15-20 black seeds are embedded.

### Plant propagation

Tree bean is commonly propagated through seeds collected from mature pods in the month of March-April and sown consecutively from April to June during the same year (Suwannarat K, Nualsri C, 2008) [22]. Due to hard seed coat, germination is very slow in *Parkia* which took around one to

two months. Nevertheless, certain pre-treatments like seed coat shelling or soaking in water followed by sowing in plentiful light and space accelerate germination and promote uniformity in seedling growth under nursery conditions (Roshetko *et al.* 2008) [16]. Six month old and 0.5 m tall seedlings of *Parkia* are suitable for transplantation in the field with 10 m × 10 m spacing between rows and plants (Wiriadinata & Bamroongrugs 2016) [26].

Observations on plant propagation through alternative means conducted at RFRI, Jorhat

Heavy mortality and declining natural regeneration due to less availability of seeds in the wild obligate us to devise *alternative means* of propagation. In the present endeavor, alternative propagation methods such as different phytohormones in varying concentrations and growth media were tested under nursery conditions. The study found that apart from seeds, tree bean can also be propagated through stem cuttings and air layering methods. For stem cutting, semi hard wood cuttings of 3-4 cm, diameter and 2-2.5 cm length, treated with 200 ppm Indole-3-butyric acid (IBA) for 2 hrs and planted in growth media having sand, soil and FYM in 1:1:1 ratio w/w was found suitable (Fig. 3a). However, in case of air-layering young branch of 2-3 cm diameter, treated with 200 ppm IBA after 2-4 cm of bark removal from lower end and wrapping exposed portion with cow dung, soil and sphagnum moss and finally with polythene bag were found very effective for early root emergence. In this study, rooting was observed after 40-60 days during rainy season (Fig. 3b).



**Fig 3:** Propagation of *P. timoriana* through a.) Stem cuttings & b.) Air-layering in RFRI Jorhat campus.

### Photochemical utility

Right from flowers and tender pods to the matured seeds of this plant is edible and is good source of ascorbic acid, fat, proteins, minerals, vitamins, polyphenol, phytosterol, flavonoids and various other antioxidants. Its hypoglycemic effect reported to be attributable to the presence of  $\beta$ -sitosterol and stigmasterol and due to that tree bean has high potential to serve as phytomedicine (Kamisah *et al.*, 2013) [9]. Flowers are a good source of ascorbic acid, proteins and minerals, sodium, magnesium, phosphorus, calcium, potassium, zinc, iron and manganese (Singh *et al.*, 2009) [20]. Pungent smell is the indicator of presence of presence of Thiazolidine-4 Carbolic acid or TCA. The inorganic proximate composition, inorganic constituents and amino acid composition at the different stages is also reported by Longvah and Deosthate, 1998 [12].

### Ethnobotanical utility

Conventionally, tree bean has much significance among the tribal communities of Northeast India. Decoctions of bark, fruit and leaves are used to treat various ailments while flower, pods and seeds provide dietary supplements i.e. carbohydrates, proteins, fats, vitamins and many minerals (Seal 2011) [18]. Immature green pods of *P. timoriana* are eaten as vegetable, salad (known as Singju) and chutney which is also known as Iromba in Manipur. Iromba is prepared by mixing dry fish and pulp of tender pods. The juvenile seeds and pods of tree bean are effective in curing stomach disorder, bleeding piles and liver disorder while, paste prepared from bark and leaves is used as lotion for skin diseases, ulcer and eczema (Sinha 2001) [21]. Further due to the presence of saponin content, the pods are milled in water and used for face and hair washing (Burkill 1935& Quisimbing 1951) [4, 13]. Fermented leaf soup is helpful to cure rheumatic problems (Sharma *et al.* 1993) [19] and leaf extract are known to have anti-bacterial properties thus used against cholera and other water borne diseases.

### Economic potential

Economically *P. timoriana* is a multipurpose tree known for its subsistence products and a source of cash income. Livelihood generation through tree bean during favorable season has the potential to generate sizeable household income worth 8,000 to 10,000 per annum to the grower that

may be comparable to as even more than the income from the sale of agricultural crops (Rocky *et al.* 2002, 2004) [14, 15]. The timber of Parkia is used for making light furniture, boxes and attractive articles (Sharma *et al.* 1993) [19]. Due to high tannin content (6-15%) its bark is used in tannin industry and the wood as a source of paper pulp (Anonymous 1966) [3]. It has also been found suitable as a shade tree in tea gardens and agroforestry species in North east India (Alabi *et al.* 2005; Dhyani and Chauhan 1990) [1, 5]. Moreover, the tree bean may also act as an outstanding crop to sustain *jhum* cultivation which is a predominant land use system in hill states of north east region. The tree species in *jhum* land could be helpful to regulate ecological balance, nutrient cycling, soil erosion control on one hand and uplifting the socio-economic status of jhumias on the other (Angami *et al.* 2018; Verma *et al.* 2017) [2, 25].

### Conclusion and future prospects

*Parkia timoriana* is a multipurpose legume tree having tremendous utility and economic potential for ethnic people of north east India. However, heavy motility and receding population led to fear of getting extinct in wild from north east Himalayan region. Thus there is an urgent need to address the issues of declining tree bean population in wild and necessitate further research for mass propagation and conservation of this valuable tree species.

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