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Review Article

Buchanania Lanzan: a species of enormous potentials

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ABSTRACT

Buchanania lanzan Spreng, commonly known as char, achar and chironji, belongs to family Anacardiaceae. It was first described by Francis Hamilton in 1798. The tree is natural wild growth in the tropical deciduous forests of Northern, Western and Central India, mostly in the States of Chhattisgarh, Jharkhand, Madhya Pradesh and in Varanasi and Mirzapur districts of Uttar Pradesh. Besides India, the plant is also found in other tropical Asian countries, Australia and Pacific islands. Tree can be identified by dark grey crocodile bark with red blaze and is a good species for afforestation in bare hill slopes. Traditional indigenous knowledge reveals the immense value of almost all parts of the plant i.e. roots, leaves, fruits, seeds and gum for various medicinal uses. Buchanania lanzan, being a vulnerable medicinal plant, is included in the Red Data Book published by International Union for Conservation of Nature and Natural Resources (IUCN). This species has high socio-economic value providing livelihood to tribal population of the area and has high potential as commercial horticulture species. Unfortunately due to over-exploitation and indiscriminate harvesting (lopping and cutting), leading to very severe threat to its extinction, which call for an urgent conservation efforts at all levels. The production of this economically important forest tree species is further threatened by insect pests also. In this background, there is compelling need for developing a suitable technology facilitating easy multiplication, regeneration and conservation of the species, simultaneously imparting and disseminating proper knowledge and education to the tribal population.

Key words: Buchanania lanzan, piyar, chironji, char, potential uses.

INTRODUCTION

Buchanania lanzan Spreng, commonly known as char, achar and chironji, belongs to family Anacardiaceae. It was first described by Francis Hamilton in 1798. It is endemic in the dry deciduous tropical forests of India and is an ever-green moderate-sized tree, with straight, cylindrical trunk, upto 10-15 m height and tomentose branches. Its bark is rough, dark grey or black, fissured into prominent squares, 1.25 to 1.75 cm thick, and is reddish inside. Flowering starts in the month of November and its leaves are coriaceous, broadly oblong with a rounded base. It bears fruits, each containing a single seed known as 'chironji' and is quite popular as an edible nut. It avoids waterlogged areas, but occurs on yellow sandy loam soils. Tree can be easily identified by its dark grey crocodile bark with red blaze and is a good species for afforestation in bare hill slopes. Buchanania lanzan, being a vulnerable medicinal plant, is included in the Red Data Book published by International Union for Conservation of Nature and Natural Resources (IUCN) [1,2]. Regionally, it is known by different names. The botanical origin and vernacular names of Buchanania lanzan are given in the Table 1.

Chironji originated in the Indian sub-continent. The tree is found as natural wild growth in the tropical deciduous forests of Northern, Western and Central India, mostly in the States of Chhattisgarh, Jharkhand, Madhya Pradesh and in Varanasi and Mirzapur districts of Uttar Pradesh [3]. Besides India, the plant is found distributed in other tropical Asian countries, Australia and Pacific islands also.

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The species has high socio-economic value providing livelihood to tribal population of these areas and has high potential as commercial horticulture species. It is a common associate of sal (Shorea robusta), teak (Tectona grandis), dhok/kaldhi (Anogeissus pendula) and salai (Boswellia serrata). About seven species of Buchanania have been reported in India, out of which Buchanania lanzan and Buchanania axillaries (Syn. Angustifolia) produce edible fruits. Buchanania lanceolata, an endangered species, is found in the evergreen forests of Kerala while Buchanania platyneura is found in Andaman. Other species of the genus are Buchanania lucida, Buchanania glabra and Buchanania accuminata.

Traditional indigenous uses

Traditional indigenous knowledge reveals the immense value of almost all parts of the plant like roots, leaves, fruits, seeds and gum for various medicinal uses. The roots are acrid, astringent, cooling, depurative and constipating and are useful in treatment of diarrhea. Extract of the root is also used as an expectorant and for curing biliousness and blood diseases. The leaf juice is used as expectorant, aphrodisiac, purgative, blood purifier, thirst-quencher and cures digestive disorders. It contains 2.64% tannins (0.35% gallo-tannins), triterpenoids, saponins, flavonoids and reducing sugars. Powdered or crushed leaves are applied to wounds. The chironji seeds/kernels are nutritional, palatable and used as a substitute for almonds in confectionery. The seeds possess 3.0% moisture and are rich in lipid/fat (59.0%), protein (19.0–21.6%), starch/carbohydrate (12.1%), fibre (3.8%), minerals like calcium (279.0 mg), phosphorus (528.0 mg), iron (8.5 mg) and vitamins like thiamine (0.69 mg), ascorbic acid/vitamin C (5.0 mg), riboflavin (0.53 mg), niacin (1.50 mg) and also contain 34-47 % fatty oil which is used as a substitute for olive and almond oils. The calorific value of kernel is 650 k-cal/100g. Kernel lipids comprised mainly of neutral lipids (90.4%), consist mostly of triacylglycerol (82.2%), free fatty acids (7.8 %) and small amount of diacylglycerols, monoacylglycerols and sterols. Ointment made from its kernels is used to relieve itch and prickly heat. The oil extracted from kernels is known as ‘char’ and used for curing skin diseases and removing spots/blemishes from the face. The oil is also applied externally on glandular swellings of the neck singly, as also in combination with other herbal oils. Chironji seeds are tolerant to desiccation and chilling and show 95-100% survival upto 90 days at all storage temperatures with gradual loss in germination after 280 days of storing [4-7]. The seeds are used for preparing a traditional sweet dish known as ‘chirongi ki burfi’. Average annual seed collection is 300 to 1200 quintals in Madhya Pradesh alone. It is an income-generating produce for the forest dependent communities. On an average, 40–50 kg fresh fruits are produced per tree, which come down to 8–10 kg on drying, yielding 1.0–1.5 kg of finished produce per tree [8]. The fruits are laxative and are used to relieve thirst, body-burning, fever, cough and asthma. Bark yields tannin (upto 13%) which is used in the tannin industries. The tribals of Southern Bihar blend the powder of the stem bark and Syzygium cumini (Myrtaceae) together and the same is given to treat infantile diarrhea. The gum oozed from the cut-bark is soluble in water and used internally for treatment of intercostals pain and diarrhea. The gum is mixed with goat`s milk for effective and curative results in intercostal pains, being analgesic. Some tribal communities of Andhra Pradesh consume a blend of the gum dissolved in cow`s milk for treating rheumatic pains. It is believed that the production and collection of about 175 metric tons of char gum is from Mandla, Dindori, Umaria, Shahdol, Katni and Chhindwara districts of Madhya Pradesh (India). The gum is generally used for adulteration of guggul (Commiphora wightii) by adding some perfume/scent. In the tobacco industry it is used for the refinement. The superior quality gum is used in soft drinks and edibles for coloring.

The timber of chironji is slightly resistant to termite and is utilized for making furniture, boxes and crates, desks, fine furniture, match boxes, moulding, packing cases, stools, tables and agricultural implements. The tribal communities of Sonbhadra District, one of the most backward districts of Uttar Pradesh and a part of the Vindhyan zone, earn money by collecting gum and lac by rearing kusumi strain of lac on the chironji trees. Thus, Buchanania lanzan is a socio-economically important underutilized life-support and tropical medicinal species for the tribal populace of North, West and Central India. But unfortunately due to over-exploitation and indiscriminate harvesting (lopping and cutting) considerable reduction in the population of Buchanania lanzan has been recorded in the recent past, leading to severe threat of its extinction, which needs urgent conservation efforts [9-11]. The production of this economically important forest tree species is threatened by insect pests also. Of them, stem borer Plocaederus obesus is the most harmful insect pest in Central India [12-15].

RESEARCH LITERATURE REVIEW

Seed/kernel: Sengupta and Roychoudhury in 1977 [16] reported the fatty acid composition of Buchanania lanzan seed oil by urea complex formation, using gas liquid chromatography (GLC).

Their study revealed that Buchanania lanzan seed oil contained myristic (0.6%), palmitic (33.4%), stearic (6.3%), oleic (53.7%) and linoleic (6.0%) acids and it might be a promising commercial source of palmitic and oleic acids. Determination of lipid composition of chirongi kernel revealed the presence of neutral lipids (90.4%), glycolipids (3.4%) and phospholipids (6.2%). Neutral lipids consisted mostly of triacylglycerols (82.2%), free fatty acids (7.8%) and small amount of diacylglycerols, monoacylglycerols and sterols as also three glycolipids and six phospholipids [17].

The in vivo anti-inflammatory activity of methanolic extract of Buchanania lanzan kernel using carrageenan-induced paw edema as an acute model and the formaldehyde induced arthritis as a chronic model, has been reported by Warokar et al. in 2010 and they found that the 200 mg/kg body weight of extract significantly decreased paw volume. They also studied the in vitro antioxidant activity of the methanolic extract by 1,1-diphenyl-2-picryl hydrazyl (DPPH) method and found that 125 µg/ml of extract exhibited 83.11 and 88.34% scavenging DPPH and % reducing power respectively as compared with the standard antioxidant ascorbic acid (99.58%, 98.92%) [18]. Feeding of ethanolic extracts of dry fruits of Prunus amygdalus (almond) and Buchanania lanzan significantly stimulated both cell mediated immunity (CMI) and humoral immunity in BALB/c mice as evidenced by the enhancement of macrophage migration index (MMI), haemagglutinating antibody (HA) titres, and plaque forming cell (PFC) counts suggesting that these could be given to mothers after child birth or to invalids for enhancing their immunity [19]. The antioxidant activity and total phenolic content of methanolic extract of different dry fruits viz. almond, walnut, cashew nut, raisin and chironji by several chemical and biochemical assays including reducing power, lipid peroxidation damage in biomembranes, determination of antioxidant enzymes activity have been studied by Mishra et al. They found that methanolic extract of walnut showed higher value of antioxidant activity based on lipid peroxidation assay.

The higher phenolic content was found in walnut followed by almond, cashew nut, chironji and least in raisin. Walnut revealed the best antioxidant property, presenting lower EC_{50} values in all assays except in antioxidant enzymatic activity [20]. Isolation of a novel and potent bio-material from the seeds of Buchanania lanzan and evaluation of its bio film forming ability, by formulating various ophthalmic films using PEG-400 as plasticizer, and the ultimate drug release studies from the formulated ophthalmic films exhibited a promising stability, swelling index, folding endurance and sustainability for a period of 8 hrs., establishing that the isolated bio-material could act as a novel film former for formulating various ophthalmic films [21]. Tyagi and Madhav [22] reported the formulation of three different zidovudine micro emulsions, using the bio-emulsifier isolated from the seeds of Buchanania lanzan and the formulated micro-emulsions exhibited promising transparency, stability, uniform globule size and shape and surface tension for a period of 24 hrs. during drug release studies.

Fruit: Rai reported the methods of propagation and estimation of fruit yield of Buchanania lanzan Spreng. in 1982 [23]. The wound healing effect of alcoholic extract of fruits of Buchanania lanzan and its effect in dexamethasone suppressed wound healing was studied in Albino rats using three types of wound models i.e. incision, excision and dead space wounds and it was reported that the presence of flavonoids in Buchanania lanzan enhanced pro-healing activity [24].

Leaves: The leaves of Buchanania lanzan are reported to have immense medicinal value. Preliminary phytochemical investigation on leaves of Buchanania lanzan using TLC (Thin Layer Chromatography) and HPTLC (High Performance Thin Layer Chromatography) techniques revealed the presence of flavonoids, tannins, glycosides, phenols, steroid, saponin and myricetin 3′-rhamnoside-3-galactoside [25-28]. Mitra and Mehrotra [29,30] carried out pharmacognostical studies of leaf and bark of Buchanania lanzan Spreng. in 1981 and its fruits and seeds in 1982 [31]. Verma et al. [32] have reported that the methanolic extract of leaves of Buchanania lanzan Spreng. was more effective against gram negative bacteria (Vibrio chlorae and Klebsiella pneumonae) when tested by paper disc diffusion method. Similarly, Manjunath and Mithun have also found that the methanolic extract of leaves of Buchanania lanzan was more significantly active against Escherichia coli, Salmonella typhi, Staphylococcus aureus, Bacillus subtilis in comparison to extracts of Buchanania lanzan leaves in petroleum ether, chloroform and water [33]. Adaptogenic (anti-stress) activity of methanolic extract of leaves of Buchanania lanzan using the swim endurance model in all groups under normal and stressed conditions was carried out by Mehta et al. The methanolic extract exhibited significant anti-stress activity in a dose-dependent manner [34]. Evaluation of antidiabetic, antihyperlipidemic and antioxidant activity of the methanol extract of leaves of Buchanania lanzan in streptozotocin-induced types I and II diabetic rats have been reported by Sushma et al. in 2013 [35].

Bark: Chaudhary et al. in 2001 studied the effect of aqueous extract of the bark of Buchanania lanzan Linn. on behaviour and chromatophores of a fresh water fish, Labeorohita and observed that in higher doses 450 ppm and 550 ppm fish could survive only for 76 hr. and 4.30 hr. respectively due to the toxicity of plant. They have reported that the doses ranging from 150 ppm to 350 ppm were psychoactive in nature [36]. Curative properties of methanolic extract of Buchanania lanzan bark as evaluated by its antioxidant, anti-inflammatory and DNA protective properties revealed that the methanolic extract could scavenge 2,2'-azino-bis (3-ethyl benzothiazoline-6-sulphonic acid) (ABTS) radicals with IC_{50} of 0.25 mg/ml. The extract also significantly inhibited 15-lipoxygenase (15-LOX) and human cycloxygenase (COX-2) in a dose-dependent manner, besides abolishing elastase activity. Further, the methanolic extract could prevent damage to DNA from the hydroxyl radicals produced during Fenton reaction [37]. Presence of chemo-protective phytoconstituents in the ethanolic extract of bark of Buchanania lanzan Spreng. offering protection against cyclophosphamide induced genotoxicity and oxidative stress in mice have been reported by Jain and Jain in 2012 [38]. The in vitro screening of methanolic extracts of the leaf and bark of Buchanania lanzan was carried out using DPPH, ABTS and H_2O_2 (Hydrogen peroxide) radicals. The bark and leaf extracts exhibited potent inhibition against ABTS radical generation. The extracts showed good activity against DPPH radical, but in H_2O_2 method leaf extract failed to show inhibition even at highest test concentration, whereas the bark extract, inhibited H_2O_2 moderately [39].

Gum: Bothara and Singh have studied the characterization of thermal property of natural gums obtained from the seeds of Diospyros melonoxylon Roxb., Buchanania lanzan Spreng. and Manilkara zapota Linn. using differential scanning calorimetry (DSC), differential thermal analysis (DTA) and thermogravimetric analysis (TGA) under nitrogen atmosphere. They have reported that these gums are thermally stable and can be used as release modifiers in various dosage form [40]. Chirauli nut gum was isolated from the bark of Buchanania cochinchinesis (Family: Anacardiaceae) and was used as a release modifier for the preparation of Diclofenac sodium spheroids, using the extrusion spheronization technique [41].

Root: The rhizome of Buchanania lanzan finds an important place in indigenous medicine as an expectorant, diuretic and carminative. It is also found to have anticancer, antihypertensive, larvicidal and antidiabetic activities [42-44]. In vitro antioxidant activity of methanolic extract of root of Buchanania lanzan Spreng. exhibited strongest radical scavenging activity (EC_{50} 0.24±0.02) by DPPH method in comparison to two other methods and the solvents as well [45]. Patnaik et al. [46] in 2011 have reported that the methanolic extract of roots of Buchanania lanzan Spreng. could be a potential source of an analgesic and anti-inflammatory agent. For assessing the analgesic activity, two concentrations of the methanolic extract of root (200 and 400 mg/kg orally) were taken for acetic acid-induced writhing model and hot plate reaction time model in Swiss albino mice. Analgesia produced by 400 mg/kg was more significant ($p<0.01$) when compared with that of 200 mg/kg. Similarly, 400 mg/kg significantly reduced the edema formation of rat paw at 1 and 3 hr. after carrageenin injection ($p<0.05$ and $p<0.01$ respectively) when tested for anti-inflammatory activity. The antiulcer activity of ethanolic extract of roots of Buchanania lanzan Spreng. was investigated by Kodati et al. adopting two experimental models i. e. ethanol induced gastric ulcer and pylorus ligation induced gastric ulcer. Ulcer index parameter was used for the evaluation of antiulcer activity since ulcer formation is directly related to factors such as reduction in gastric volume, decrease in free and total acidity. They found that the oral administration of root's extract at 200-400 mg/kg in pylorus ligature inhibited the total ulcer index by 60.4±2.9 to 69.5±3.7 percent in dose dependent manner as compared with control [47]. Roots of Buchanania lanzan Spreng. contain tannins, saponins and flavonoids and the presence of tannins in Buchanania lanzan probably contributed to its antidiarrheal activity. Castor oil induced diarrheal test was used to assess the antidiarrheal activity and the gastrointestinal tract transit of charcoal meal test was used to assess the antipropulsive activity of the alcoholic extract of Buchanania lanzan Spreng. roots. The study revealed that the extract significantly delayed the onset of diarrhea induced by castor oil and also reduced the number of animals exhibiting diarrhea [48]. Methanolic extract of root of Buchanania lanzan Spreng. displayed significant wound healing activity in excision model as also antimicrobial activity against Gram positive (Staphylococcus aureus MTCC 96 and Bacillus subtilis MTCC 441) and Gram negative (Escherichia coli MTCC 2939 and Pseudomonas aeruginosa MTCC 2453) bacteria. It was also able to reduce biofilm formation and cause disruption to preformed biofilms in a manner similar to ciprofloxacin [49].

CONCLUSION

Medicinal plants are integral and indispensable part of the traditional system of medicine practiced

worldwide because of their economical viability, easy accessibility and centuries old experience. As Nature's gift, these are considered to be biocompatible, environment friendly, non-toxic, much cheaper and quite freely available in comparison to synthetic substances. Besides, these are amongst the richest renewable source of biopolymers, having enormous potentials for use and application in numerous fields like foods, cosmetics, pharmaceuticals and host of other industries. With a view to augmenting their sustainable production, conservation, livelihood security and fullest utilization, proper research support is an urgent requirement for addressing the problems related to scientific tapping, harvesting, collection, processing (drying, grading, handling/ storage), value addition and upgrading the product quality. This species has a high socio-economic value for providing livelihood to the tribal population of the area besides possessing enormous potentials as commercial horticulture species. Unfortunately due to over-exploitation and indiscriminate harvesting (lopping and cutting), considerable reduction in the population of Buchanania lanzan has been recorded in the recent past, leading to very severe threat to its extinction, which calls for urgent conservation efforts at all levels. The production of this economically important forest tree species is further threatened by insect pests also. In this background, there is compelling need for developing a suitable technology facilitating easy multiplication, regeneration and conservation of the species, simultaneously imparting and disseminating proper knowledge and education to the tribal population for stopping the practice of destructive harvesting and spreading sufficient awareness regarding collection of ripe fruits at appropriate timings.

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Table 1: Botanical origin and vernacular names of Buchanania lanzan

Botanical origin		Vernacular names	
Kingdom:	Plantae	Bengali:	Chironji
Order:	Spindales	Hindi:	Achar, Char, Baruda, Priyala
Family:	Anacardiaceae	Gujarati & Marathi:	Charoli, Pyalchar
Sub-family:	Anacardioideae	Kannada:	Charpoppu
Genus:	Buchanania	Malyalam:	Mungapper
Species:	Buchanania lanzan Spreng.	Oriya:	Charu
		Sanskrit:	Priyalam, Char, Rajadana, Dhanu.
		Tamil:	Morala
		Telugu:	Saarachettu, Morichettu.

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