Unlocking The Potential of Nature's Pharmacy: A Review on Medicinal Plant (Buchanania Lanzan Spreng) and Its Therapeutic Applications

[1]Chandrakant D. Chakote*, [2]Priyanka A. Shelke, [3]Amruta A. Hajare, [4]Aditya A. Bogar, [5]Suchita P. Ramteke.

[1,2,3,4]Master of Pharmacy
Department of Pharmaceutical Chemistry
School of Pharmacy, Swami Ramanand Teerth Marathwada University
Nanded, India.

***Abstract*- Lanzan Buchanania Spreng, a dry deciduous forest tree belonging to the Anacardiaceae family, has been traditionally used by Indian tribes to treat a variety of ailments. The assembled data may assist researchers to focus on the priority areas of research that have yet to be found. The plant's complete information has been gathered from many books and periodicals. This review aims to provide a comprehensive update on current and upcoming areas of study on this plant, particularly in the fields of phytomedicines, pharmacological characteristics, and pharmaceuticals.**

Keywords: **Buchanania lanzan Spreng., Chironji, Phytopharmacological Review, Anacardiaceae**.

1 Introduction

Herbs are plants or plant parts that are utilized for their smell, flavour, or medicinal properties. The term "herb" is derived from the Latin word "herba" and an old French word "herbe". Any plant part, such as a fruit, seed, stem, bark, flower, leaf, stigma, or root, as well as a non-woody plant, is now referred to as a herb. Previously, the term "herb" referred only to non-woody plants, including those derived from trees and shrubs. These medicinal plants are also used for food, as a flavonoid, medicine, or perfume, and for spiritual purposes.

1.1 Botanical Description

Buchanania lanzan Spreng. is a member of the Anacardiaceae family, which originates in the Indian subcontinent, and is a versatile tree species [1]. Buchanania cochinchinensis (Lour.) M.R. Almeida is a synonym of Buchanania lanzan Spreng [4]. Francis Hamilton reported it for the first time in 1798 [2]. Traditional indigenous knowledge demonstrates the great therapeutic benefit of practically all plant components, including roots, leaves, fruits, seeds, and gum [Figures 1, 2, and 3] [1]. The tree grows natively in the tropical deciduous woods of North, Western, and Central India, where the climate is predominantly monsoonal [3].

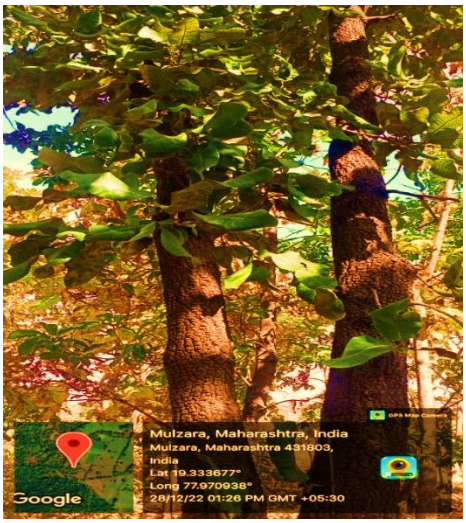

Figure 2: Tree of Buchanania lanzan Spreng.

Figure 1: Leaves and Flowers of Buchanania lanzan Spreng.

1.2 Scientific classification

Kingdom	Plantae
Phylum	Tracheophyta
Class	mangnoliopsida
Order	Sapindales
Family	Anacardiaceae
Subfamily	Anacardioideae
Genus	Buchanania
Species	B. lanzan
Binomial Name	Buchanania lanzan

Table 1: Scientific Classification

1.3 Morphology of the plant

Buchanania lanzan is a beneficial evergreen tree with therapeutic properties [7]. It can reach a height of 12 meters (39 feet) by 10 meters (32 feet) at a medium rate [8]. Petiole 12-22 mm, stout, glabrous; lamina 10-23.5 x 5-12 cm, broadly oblong, base round or acute, apex obtuse or emarginate, margin entire, glabrous above and densely tomentose beneath, coriaceous; lateral nerves 10-20 pairs, pinnate, prominent, pubescent, secondary laterals prominent, intercostal prominent [8].

Figure 3: Fruit of Buchanania lanzan Spreng.

The endocarp of B. lanzan is multilayered, with crystalline outer cells and sclereids intertwined with a mass of cells in the interior five or six-cell layers, according to an anatomical study [3]. Morphological studies revealed exalbuminous and polymorphic seeds with weight variation [3].

General description [5,6]

English Name: almondette, cheronjee, cuddapah Almond
Marathi Name: Char, Chareli, Charoli, Chiraoli, Chirauli, Pyalchar
Hindi Name: achar, char, charoli, charoli-kernel, chiraunji, chironji,
Kannada Name: chaara pappu, chaaruvaala, chalaali, char, charoli,
Sanskrit Name: akhatta, bahulavalkala, cara, chara, charaka, dhanu, dhanushpatta, Priyalam
Tamil Name: modama, moraimaram, morala, mudaikkai, mudaima
Oriya: Charu
Parts Used: roots, leaves, fruits, seeds

1.4 Traditional Use

Buchanania lanzan (Anacardiaceae) is a miraculous herb that Indian tribes utilize to treat a variety of diseases [1]. Traditional indigenous knowledge demonstrates the tremendous therapeutic benefit of practically all plant components, including roots, leaves, fruits, seeds, and gum [9]. Chironji (Buchanania lanzan) effectively reduces vata, is unctuous, and has a cool potency; its marrow is pleasant, aphrodisiac, and reduces pitta and vata [10]. Buchanania Lanzan is also listed in the International Union for Conservation of Nature and Natural Resources (IUCN) Red Data Book [9].

The leaves have traditionally been used to treat wounds as well as a digestive, expectorant, and purgative [11]. The bark's gum is used to cure diarrhea and intercostal discomforts, while the leaves are used to promote wound healing [11] It is also used as an analgesic after being mixed with goat milk [1]. According to some sources, the plant can also be used as a cardiotonic, astringent, and for the treatment of skin problems and glandular swelling [11][9]. The root is used as an expectorant as well as to treat blood diseases [11]. Traditional medicine uses the tree's gum to treat leprosy [1].

1.5 Phytochemistry

Tannins, triterpenoids, saponins, flavonoids, kaempferol-7-o'glucosides, quercetin-3-rahmnoglucoside, quercetin, gallic acid, kaemferol, and reducing sugars have been found in Buchanania lanzan leaves [12]. A study on the leaves of Buchanania Lanzan

(Anacardiaceae) found chemical elements such as pinitol, vomicine, and celidoniol in the methanolic extract [12]. Another study discovered alkaloids and phenolic substances in B. lanzan methanolic leaf extract [13].
Phytochemical investigations revealed that both ripened and unripe fruits contain alkaloids, phenols, flavones, saponins, coumarins, glycosides, and tannins [14]. A detailed physiochemical analysis of the seeds reveals that they are an active source of phenolics, natural antioxidants, and minerals [15].

Extract	Total Phenolics (µg GAE mg-1)	Flavonoid Content (µg CE mg-1)
PEE	5.78	13.74
DCME	6.73	7.08
ME	10.05	5.21
EWE	13.42	11.41

Table 2: Total phenolics and flavonoid content in different extracts of Fruit [14] (petroleum ether extract (PEE), dichloromethane extract (DCME), methanolic extract (ME), and ethanol and water extract (EWE).
Flavonoids, Saponins, Amino acids/proteins, Carbohydrates, and Tannin were discovered in gum exudates by phytochemical screening [16]. The presence of tannins, saponins, specifically steroidal saponin, and flavonoids was discovered in the roots of Buchanania lanzan Spreng [17].

2 Pharmacological Studies

Sr. No.	Plant Part	Name of Activity	Reference
1	Methanolic Leaf extract of B. lanzan	Antidiabetic and Antihyperlipidemic Activity	[33]
2	Root extract of B. lanzan	Wound healing activity with an emphasis on antibacterial and anti-biofilm characteristics	[18]
3	Leaf extract of B. lanzan	Anti-Microbial activity	[19]
4	The ethanolic root extract of B. lanzan	Anti-Ulcer Activity	[20]
5	Methanolic extract of B. lanzan seeds	Effect on Hematological Indices	[21]
6	Alcoholic extract of B. lanzan	Anthelmintic activity	[48]
7	Alcoholic extract of B. lanzan Spreg roots	Anti-diarrhoeal activity	[17]
8	Ethanolic bark extract of B. lanzan	Effect on cyclophosphamide-induced genotoxicity and oxidative stress	[22]
9	Alcoholic extracts of B. lanzan seeds	Antioxidant Activity	[25], [38]
10	Methanolic extract of B. lanzan kernel	DNA Protective Activity	[24]
11	Ethanolic extract of B. lanzan Spreng	Cardio Protective Activity	[26]
12	Petroleum ether extract of B. lanzan seeds	Memory booster	[29]
13	Methanolic extract of B. lanzan leaves	Anti-inflammatory activity	[30]
14	Aqueous and ethanolic extracts of B. lanzan seeds	Analgesic and Antipyretic Activity	[32]
15	Buchanania angustifolia and Buchanania lanzan	Diuretic Activity	[31]
16	Methanolic extract of B. lanzan leaves	Adaptogenic activity	[35]
17	Ethanolic extract of B. lanzan bark	Antivenom activity against Naja kaouthia snake venom	[37]

Table 3: Pharmacological Studies on different parts of the Buchanania Lanzan.

Antidiabetic and Antihyperlipidemic Activity
Diabetes mellitus is a chronic metabolic disorder characterized by an absolute or relative deficit of insulin and/or decreased insulin action, resulting in hyperglycemia and improper carbohydrate, protein, and fat metabolism. A metabolic consequence of both clinical and experimental diabetes is hyperlipidemia. The anti-diabetic and anti-hyperlipidemic effect of Buchanania lanzan Leaf methanolic extract was investigated in Streptozotocin-induced type I and type II diabetic rats. Methanolic Leaf extract of B.lanzan was supplied for 21 days at doses of (100 and 200 mg/kg p.o), which significantly ($p < 0.05$) reduced blood glucose levels in a dose-dependent manner. As a result, it was established that the plant's anti-diabetic and anti-hyperlipidemic actions may be associated with its active ingredients, which include glycosides, carbohydrates, sterols, and flavonoids [33].

Wound healing activity with an emphasis on antibacterial and anti-biofilm characteristics

The root extract (B. lanzan) was tested for wound healing characteristics using excision and incision wound repair models. Topical treatment of B. lanzan (10% w/w ointment) significantly improved wound healing in both excision and incision models, with significant activity beginning on the 9th day. Soframycin, on the other hand, showed considerable wound healing activity as early as day 6 of treatment. This treatment increased the rate of wound contraction, thereby decreasing the time of healing in comparison to the control group of animals. It would be interesting to note that the 10% w/w ointment created a speedier onset of the healing process as well as a shorten period for the whole healing to occur. The extract helped in the multiplication of epithelial cells adhering to wounding (from wound edges), hence accelerating wound re-epithelialization and wound closure. It was discovered that B. lanzan root extracts inhibited all pathogens tested significantly. B. lanzan showed antibacterial activity against both Gram-positive and Gram-negative bacteria (MIC 0.625-1.25 mg/mL). B. lanzan was capable of reducing biofilm production as well as disrupting established biofilms in a way similar to ciprofloxacin. Gentamicin, on the other hand, was found to be ineffective against Gram-negative biofilms. B. lanzan had a synergistic effect when combined with gentamicin, which was consistent with the fractional inhibitory concentration index. It is practical to conclude that B. lanzan root extract has great wound healing ability, which is supported and well associated with the noticeable antibacterial activity of the examined plant parts [18].

Anti- Microbial activity

The antibacterial and antifungal properties of Buchnania Lanzan leaf extract were comparable to those of common antibiotics such as ampicillin, penicillin-G, streptomycin (10 units/disc), and fluconazole (10mg). In comparison to extracts of petroleum ether, chloroform, and water, the methanol leaf extract of Buchanania lanzan revealed greater antibacterial activities. The maximum antibacterial activity was observed in E. coli followed by P. aeruginosa and S. aureus, while in the case of antifungal activity Aspergillus spp. was found to be more sensitive than Penicillium [19].

Anti–Ulcer Activity

Peptic ulcer disease is a significant gastrointestinal disorder that requires a well-targeted treatment plan. The antiulcer activity of B. lanzan's ethanolic root extract has been studied. Various dosages of the ethanolic root extract (200 and 400 mg/kg orally) were tested for anti-ulcer efficacy in mice and rats with pylorus ligation caused ulcers. The ethanolic extract demonstrated dose-dependent and significant ulcer index protection in both models, as well as inhibiting pylorus ligation-accumulated gastric secretion. As a result, the extract has a good preventative and therapeutic effect on stomach ulcers [20].

Effect on Hematological Indices

The effects of the methanolic extract of Buchanania lanzan Spreng seeds on hematological parameters were investigated in a study. Eighteen male albino Wistar rats were divided into three groups, six in each. Animals in Group I were given distilled water, while those in Groups II and III were given an oral dose of 1000 mg oil/kg and 2000 mg oil/kg of the extract, respectively, for 7 days. Blood was collected at the end of the trial and tested for packed cell volume (PCV), hemoglobin (Hb) concentration, red blood cell (RBC), and white blood cell (WBC) counts. In the therapy group, there was a significant dose-dependent rise in hematological indices such as PCV, Hb, RBC, and WBC count. The improvement in PCV, Hb, and RBC values indicates an anti-anemic impact, which may be due to RBC production stimulation in the bone marrow [21].

Anthelmintic activity

Anthelmintic activity was tested on Pheritima Posthuma using Albendazole as a reference, and the alcoholic extract was more effective than ethyl acetate and chloroform extracts because it takes less time to paralyze and kill earthworms [48].

Anti-diarrhoeal activity

Diarrhea is characterized by an increased frequency of bowel sound and movement, wet stool, and abdominal pain and is described as an increase in the frequency, fluidity, or volume of bowel movements [38]. The antidiarrheal activity of the alcoholic extract of Buchanania lanzan Spreg roots was assessed using a castor oil-induced diarrhoeal test and a gastrointestinal tract transit of charcoal meal test was used to assess the anti-propulsive activity. The alcoholic extract of Buchanania lanzan Spreg roots significantly reduced faecal output in castor oil-induced diarrhea, as well as the number of diarrhoeal episodes and significantly delayed the onset of diarrhea and significantly reduced the number of animals exhibiting diarrhea. Buchanania lanzan Spreg significantly reduced charcoal meal intestinal propulsion in mice [17].

Effect on cyclophosphamide-induced genotoxicity and oxidative stress

Buchanania lanzan bark exhibits high polyphenol content, and in vitro antioxidant activity, and traditional use of this plant in cancer prevention lead us to explore the effect of ethanolic bark extract on cyclophosphamide-induced genotoxicity and oxidative stress in mice. As intermediate indicators for chemoprotection, the prevalence of micronuclei in bone marrow, the amount of lipid peroxidation, reduced glutathione, and the state of the antioxidant enzymes, superoxide dismutase, and catalase in mouse liver were utilized. The mice were pre-treated with B. lanzan extract at doses of 250, 500, and 1000 mg/kg, p.o., daily for seven days, which greatly reduced chromosomal damage and lipid peroxidation while also altering antioxidant and detoxification systems. In the liver of cyclophosphamide-treated mice, lipid peroxidation and impaired antioxidant defenses were found. This study shows that the presence of chemopreventive phytoconstituents in the crude extract protects against cyclophosphamide-induced genotoxicity and oxidative stress in mice [22].

Antioxidant Activity

In this study, the antioxidant activity of alcoholic extracts was quantified utilizing the polyphenolic content of Buchanania lanzan seeds extracted using traditional methods such as cold maceration and Soxhlet extraction. The total phenolic and flavonoid content was determined, with cold macerated extract having the highest phenolic and flavonoid content and soxhlet extract having the lowest. The anti-oxidant activity is measured using the DPPH and FRAP tests. In the DPPH experiment, the cold macerated extract had higher anti-oxidant activity, with 50% inhibition at a concentration of 273.62 ±1.61 µg/mL compared to soxhlet extract, which demonstrated 50% inhibition at 670.7 ±4.03 µg/mL. The ability of these extracts to reduce was also examined. The results showed that cold macerated extract had a higher reduction ability than Soxhlet extract. As a result, the cold-macerated alcoholic extract was discovered to be a better antioxidant with increased phenolic and flavonoid content [25].

The antioxidant activity of a methanolic extract of B. lanzan kernel is measured in vitro using the 1, 1-diphenyl-2-picryl-hydroxyl (DPPH) and reducing power methods. The Folin-Ciocalteu method is used to calculate the total polyphenolic content of the extract. The extract has a high level of antioxidant activity. The total polyphenolic content is 16.82%±23 mg of gallic acid equivalent/100. The presence of phytochemicals in the extract, such as triterpenoids, saponins, and tannins, may contribute to the reported antioxidant activity [39].

DNA Protective Activity

Most anti-cancer drugs are thought to work primarily by quenching free radicals or by interacting directly with DNA [23]. The methanolic extract of B. lanzan is being tested for its ability to prevent DNA damage. In this investigation, plasmid DNA (pBR322) was subjected to the Fenton reaction at 37oC for 30 minutes. The Fenton reaction changed the native double-stranded DNA band (Form I) to single-stranded, nicked DNA (Form II), as proven by agarose gel electrophoresis. In contrast, when treated with Fenton reagent under comparable conditions, DNA preincubated with varied concentrations, viz., 10, 25, and 50 µg of the extract, inhibited scission. The DNA nicking assay determines the extract's ability to quench free radicals that are damaging to DNA [24].

Cardio Protective Activity

The cardioprotective efficacy of an ethanolic extract of Buchanania lanzan Spreng. (EEBL) against isoproterenol-induced myocardial infarction in rats is examined by looking at myocyte injury markers, the antioxidant defense system, serum, and electrocardiographic alterations. Myocardial infarction in rats was induced by isoproterenol administration (200 mg/kg, s.c.) at an interval of 24 h on the 29th and 30th day. Biochemical indicators were evaluated on the 30th day of ECG. Isoproterenol administration caused changes in the ECG pattern, such as ST-segment elevation (a sign of myocardial infarction), an increase in the serum levels of cardiac injury markers (Creatine kinase-MB, lactate dehydrogenase, aspartate transaminase, and alanine transaminase), and a decrease in the antioxidant defense system in the heart. In rats, EEBL pre-cotreatment protected nearly all of the characteristics of isoproterenol-induced myocardial infarction. According to the findings of this investigation, EEBL has a considerable effect on heart protection against isoproterenol-induced myocardial infarction via preserving endogenous antioxidant enzyme activity [26].

Memory booster

Alzheimer's disease is a progressive neurodegenerative brain ailment that causes memory loss, strange behavior, personality changes, and death [27]. Biochemical abnormalities such as acetyltransferase, acetylcholine biosynthases, and an increase in acetylcholinesterase (AChE), as well as metabolism, are significantly linked to the degree of cognitive impairment [28]. In experimental rats, a petroleum ether extract of B.lanzan seeds (PEB) (500 mg/kg, oral) is being examined for its neuro-psychopharmacological impact. The effect of seeds extract on memory acquisition and retention is investigated using an elevated plus maze and step-down apparatus models, and the amount of AChE enzyme in various areas of the brain is also assessed. PEB (500 mg/kg) administration to positive control and treated groups resulted in a significant reduction in transfer latency in the elevated plus maze, an increase in step-down latency in step-down apparatus models, and a reduction in acetylcholine esterase enzyme activity in various brain regions when compared to the other groups [29].

Anti-inflammatory activity

In animal models of Carrageenan-induced rat paw edema, the anti-inflammatory effect of methanolic extract of Buchanania lanzan leaves was examined. The animals were administered methanolic extracts in concentrations of (ME- 10mg/kg, 20mg/kg, 30mg/kg, 40mg/kg, and 50mg/kg) 30 minutes before carrageenan injection (phlogistic agent) of 0.1ml dose (i.p). Carrageenan was injected into the subplantar tissue of each rat's left hind paw, and foot swelling was recorded using a plethysmometer and compared to normal aspirin at varied doses. In a dose-dependent manner, the extract demonstrated considerable anti-inflammatory activity [30].

Analgesic and Antipyretic Activity

In response to any illness or disease, the body's natural defense mechanism produces pyrexia or fever. Pyrexia creates an environment within the body in which pathogenic bacteria and dam-aged tissues cannot live. Aqueous and ethanolic extracts of Buchanania lanzan Spreng seeds. Is tested for analgesic and antipyretic activity utilizing brewer yeast-induced pyrexia and acetic acid-induced writhing, respectively. Albino mice were used in this study. The animals were given extracts in varying doses, 125, 250, and 500 mg/kg, and it was discovered that the extracts caused a dose-dependent drop in temperature as the potency increased from 125 to 500 mg/kg. The aqueous extract of seed had superior antipyretic action at a dose of 500 mg/kg, which was moderate in comparison to the standard [32].

Diuretic Activity

Using the Lipschitz et al. approach, a comparative study was conducted to evaluate the diuretic impact of Priyala fruits (Buchanania angustifolia, Buchanania lanzan) and their fractions in rats. At a dosage of 500 mg/kg BW, both B. angustifolia and B. lanzan alcoholic extracts demonstrated considerable diuresis, with diuretic indexes of 3.69 and 3.61, respectively. However, fractions demonstrated considerable diuresis, with diuretic indexes ranging from 2.19 to 2.69. According to the findings of this study, Buchanania angustifolia was shown to be a better diuretic than Buchanania lanzan at a dose of 500 mg/kg, which appeared to be comparable to that of the conventional medicine Frusemide [31].

Adaptogenic activity

Adaptogens are substances that generate an adaptive response to disease and are effective in a variety of unrelated illnesses. They appear to produce a state of non-specific enhanced resistance during stress, resulting in stress protection [34]. The methanolic extract of B. lanzan leaves is tested for adaptogenic activity in all groups under normal and stressed conditions using the swim endurance model. To assess antistress activity, urinary vanillyl mandelic acid (VMA) and ascorbic acid were used as non-invasive indicators. Spectrophotometric methods are used to determine the 24-hour urine excretion of VMA and ascorbic acid. Daily treatment of the extract at doses of 10, 20, 30, 40, and 50 mg/kg body weight before stress induction reduced stress-induced urine biochemical alterations in a dose-dependent manner while not affect levels in normal control groups. The methanolic extract was found to have strong anti-stress action [35].

Antivenom activity

B. lanzan is among the plants that exhibit anti-snake venom properties. In the Chhattisgarh region, B. lanzan fruit and bark extract is used to cure snake bites [36]. Various in vivo and in vitro investigations were conducted to test the ethanolic extract of B. lanzan bark against the toxicity generated by Naja kaouthia snake venom. The extract was tested for its ability to neutralize lethality, myotoxicity, phospholipase A2 activity, and human red blood cell lysis caused by N. kaouthia snake venom. The extract, at 200 mg/kg and 400 mg/kg concentrations, considerably reduced the mortality caused by varied concentrations of snake venom. Myotoxicity was also reduced to a great extent, as seen by a drop in creatine phosphokinase levels. In the presence of the extract, in vitro, models for measuring hemolytic activity were shown to be greatly reduced. At varying concentrations of extract, both direct and indirect hemolytic studies were performed. The extract considerably reduced hemolysis by more than 50%. The results demonstrated that the toxicity induced by N. kaouthia snake venom was significantly neutralized [37].

3 Applications in Novel Drug Delivery System

Sr. No.	Plant Part/Material	Formulation	Reference
1	Seeds of B. lanzan	Ophthalmic biofilm from seed	[40]
2	Seeds of B. lanzan mucilage	Oral Mucoadhesive Tablets	[41]
3	Seeds of B. lanzan	Biostabilizer in Selegiline Bionanosuspensions	[42]
4	Seeds of B. lanzan (Spreng) Seed Oil	Transdermal patches using B.lanzan (Spreng) Seed Oil	[43]
5	Seeds of B. lanzan	Zidovudine Nanosuspensions Using a Novel BioPolymer	[44]
6	Chironji gum (from Buchanania lanzan)	Emulsifying Properties of a Water-Soluble Gum Polysaccharide	[45]
7	Seeds of B. lanzan	Zidovudine Micro Emulsion Using a Novel BioPolymer	[46]
8	Roots of B. lanzan (methanolic root extract)	Hydrogel Formulation	[47]

Table 4: Applications in Novel Drug Delivery System

Ophthalmic biofilm from seed

A novel biomaterial was obtained from the seeds of B. lanzan and its biofilm-forming potential was assessed by manufacturing different ophthalmic films with polyethylene glycol 400 as plasticizer and biomaterial as biofilm former. Four formulations were created utilizing the film casting technique and a biofilm maker in various ratios. Weight variation, homogeneity thickness, folding durability, hardness, surface pH, swelling index, and in vitro release investigations were all performed on the prepared ophthalmic films. The drug release trials from the prepared ophthalmic films demonstrated promising stability, swelling index, folding endurance, and sustainability over an 8-hour period. The isolated biofilm former is a unique film former that can be used to create a variety of ophthalmic films [40].

Oral Mucoadhesive Tablets

The oral mucoadhesive medication delivery system was developed using Buchanania lanzan Spreng seeds mucilage and tested for mucoadhesive characteristics in a compressed tablet containing losartan potassium. Mucilage was employed in four different concentrations, namely 21, 42, and 55% w/w, and Granules were made utilizing polyvinylpyrrolidone as a binding agent. The physical properties of these tablets were evaluated, followed by in vitro dissolving and swelling index determination. The bioadhesive strength of isolated mucilage was compared to Guar gum and HPMC E5LV, which were employed as standard mucoadhesive agent concentrations evaluated on a modified physical balance. The results showed that tablets had good physiochemical qualities, drug release was delayed as mucilage concentration was raised, and it had a relative effect on drug release

from formulation. For three months, all formulations were subjected to stability experiments, and all formulations demonstrated stability in terms of the release pattern. Based on these findings, it is concluded that BL seed mucilage can be used as an excipient in oral mucoadhesive drug delivery systems [41].

Biostabilizer in Selegiline Bionanosuspensions

The biopolymer isolated from the seeds of Buchanania lanzan is used as a stabilizer and standard stabilizer (hydroxypropyl methylcellulose) by sonication solvent evaporation methods in different ratios (1%, 2%, 3%, 4%, and 5%), and it is evaluated for particle size, polydispersity index, zeta potential, pH stability studies, percentage entrapment efficacy, in vitro drug release, and stability studies. According to the findings of this investigation, the biopolymer extracted from the seeds provided good stability and particle size for the optimal formulation. The optimum formulation has a polydispersity index of 0.43 and a zeta potential of -5.12 mV [42].

Transdermal patches using B.lanzan (Spreng) Seed Oil as Penetration Enhancer

The permeation improvement properties of Buchanania lanzan spreng seed oil were investigated utilizing Ethyl cellulose transdermal patches of Glipizide with essential oils as penetration enhancers. The effect of drug loading and penetration enhancers on drug permeation through rat skin was studied in vitro. The use of essential oils enhanced the moisture content, moisture uptake capacity, and Glipizide penetration across epidermal barriers. When compared to other oils, Buchanania lanzan spreng seed oil has been proven to be the most effective. It was also concluded that seed oil can be employed to improve the penetration of various types of tropical preparations [43].

Zidovudine Nanosuspensions Using a Novel BioPolymer

A novel biomaterial is obtained from the seeds of Buchanania lanzan using a simplified economic method, and its effectiveness for sustained drug administration is assessed by producing different Nano suspensions with methylene chloride as an organic solvent and biomaterial. Using varied ratios of biomaterial, five distinct formulations were created via solvent evaporation according to OECD criteria. The Nano suspension formulations were evaluated using characteristics such as particle size and shape, drug content, entrapment efficacy and percent transmission, and in-vitro drug release experiments. Based on in-vitro release testing, the formulation with the highest quantity of biopolymer (FNS4) was determined to be superior to the other formulations and was chosen as the optimized formulation. In-vitro tests demonstrated that FNS4 was released with perfect zero first-order kinetics. It was discovered that raising the amount of biopolymer increased the rate of zidovudine release [44].

Emulsifying Properties of a Water-Soluble Gum Polysaccharide

A water-soluble polysaccharide (CGPS) was isolated from chironji gum. Diclofenac sodium and cremophor RH40 were tested. The yield of the polysaccharide fraction was 33.85% ±0.88% w/w. According to HPLC tests, CGPS contains galactose, rhamnose, arabinose, and glucose. The average molecular weight of CGPS was 201 kDa. Analytical studies, including NMR and GC–MS, showed that CGPS had repeating units of → 4)-α-d-Galp (1 → 2)-α-l-Rhap-(1 → with terminal β-d-Glcp (1 → and α-l-Araf (1 → residues. The nanoemulsions prepared with CGPS showed a droplet size ranging from 31.41 ± 0.26 to − 65.30 ± 0.21 nm and negative zeta potential values were obtained for all the nanoemulsions. In vitro, drug release studies of the CGPS nanoemulsion formulation revealed that diclofenac sodium release was delayed in the simulated colonic fluid. This study indicates the immense potential of CGPS for colon-targeted drug delivery systems [45].

Zidovudine Micro Emulsion Using a Novel BioPolymer

The biomaterial was obtained from the seeds of Buchanania Lanzan using a simple and cost-effective approach. Three different zidovudine microemulsions were created utilizing varied amounts of the bio emulsifier. The formulated microemulsions were evaluated using characteristics such as globule size, centrifugation ph effect, viscosity, surface tension, and invitro drug release. In comparison to standard emulsions, the created microemulsions have homogeneous globule size, promising stability against centrifugation. For a period of 24 hours, the drug release investigations from the formulated micro emulsions showed promising transparency, stability, consistent globule size and shape, and surface tension. Finally, it was determined that the isolated bio-emulsifier functions as a new emulsifier in the formulation of diverse drug-loaded microemulsions [46].

Hydrogel Formulation

The gel formulations were made with different quantities of polymer (Carbopol-940) and 0.5% active component i.e. methanolic root extract of Buchanania lanzan (MEBL). The rheological characteristics, spreadability, homogeneity, and stability of various hydrogel formulations were investigated. A comparison of rheological characteristics and spreadability revealed that the gel formulations possessed all of the desirable features that are considered as necessary ailments for a standard stable gel formulation. Based on the rheological analyses of all formulations, sample F3 was determined to be a stable formulation with comparatively superior rheological properties [47].

4 Conclusion

According to the above review, the herb has traditionally been utilised for a variety of therapeutic purposes. The plant was found to have various potent pharmacological actions such as analgesic, anti-inflammatory, Wound healing, Cardioprotective, anthelmintic, antibacterial, antifungal, Antivenom activity, Adaptogenic activity, Diuretic, Memory booster, Anti- Microbial, Anti–Ulcer, Antioxidant, and DNA Protective Activity. The review also reveals that the various Applications of Buchanania Lanzan in Novel Drug Delivery Systems. The phytoconstituents found in the plant are primarily phenols, which are responsible for the

activities. More investigation is required to identify the elements responsible for the biological activities. It was also discovered that no clinical studies have been conducted till now. So, based on the current assessment of the literature, it was determined that the plant has great therapeutic value. According to traditional and ethnomedicinal literature, the herb is exceedingly useful and safe for medicinal usage. A strong and safe medicine can be researched from the plant employing reverse pharmacological procedures in natural drug development for many chronic diseases such as arthritis, liver disorders, cancer, and other inflammatory diseases.

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