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PHYTOCHEMICAL SCREENING AND EVALUATION OF PHARMACOLOGICAL ACTIVITIES OF *BUCHANANIA LANZAN* SPRENG LEAVES

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ABSTRACT: The aim of this research was to perform phytochemical screening and evaluation of the pharmacological activities of *Buchanania lanzan* Spreng. leaves. Preliminary phytochemical screening revealed the presence of phytoconstituents like steroids, tannins, saponins, carbohydrates, alkaloids, and flavonoids. Three leaf extracts were prepared by using solvents *e.g.* chloroform, ethyl acetate, and ethanol. The antibacterial activity was evaluated by using the paper disc method against *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. The chloroform extract was found to be more effective against *Pseudomonas aeruginosa* with a zone of inhibition 20 mm as compared to the standard anti-biotic ampicillin with a zone of inhibition 20 mm. Antifungal activities were evaluated by well diffusion assay against *Candida albicans*, *Aspergillus flavus*, *Aspergillus niger*. The chloroform extract was found be more effective against *Aspergillus flavus* and *Candida albicans* with a zone of inhibition 22 mm and 20 mm respectively as compared to the standard antifungal ketoconazole with a zone of inhibition 22 mm. Antifungal activity against *Aspergillus niger* with zone of inhibition 22 mm was comparable to standard Ketoconazole with zone of inhibition 24 mm. Anthelmintic activity was performed on *Pheritima posthuma* using Albendazole as standard and ethanolic extract was found to be more effective. Hepatoprotective activity performed on Wistar albino rats revealed that ethyl acetate extract was more promising using LIV 52 as standard. Therefore, it can be concluded that the *Buchanania Lanzan* leaves specific extracts possess antimicrobial, anthelmintic and hepatoprotective activity which can be further explored for the development of formulation and their structural elucidation.

INTRODUCTION: *Buchanania lanzan* Spreng. a member of family Anacardiaceae is a commercially useful tree, first described by Francis Hamilton in 1798 **Fig. 1**. It is commonly known as char, achar or chironji. The tree is native in the tropical deciduous forests of Northern, Western and Central India.

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It is also found in other tropical Asian countries, Australia and the Pacific islands [1]. The tree grows well on yellow sandy-loamy soil. The bark of *Buchanania lanzan* Spreng. is rough, with dark grey or black color. Leaves are broadly oblong, have rounded base with a blunt tip and straight parallel veins. The flowering period is between January to March. Flowers are small, greenish-white.

The fruit is a yellowish-red drupe, one-seeded, which ripens between April to May [2, 3]. Mehta *et al.*, have reported the presence of glycosides, phenolic compounds and flavonoids in the different leaf extracts of *Buchanania lanzan* from

preliminary phytochemical analysis [4]. Khatoon *et al.*, have reported the nutraceutical and phytochemical screening and demonstrated that *Buchanania lanzan* is a very rich source of polyphenols, flavonoids, tannins, alkaloids and saponins [5]. Seeds were reported to be rich sources of phosphorus, calcium, magnesium, iron, tocopherols, and essential fatty acids like oleic acids, linoleic acid, and linolenic acid. The phytochemical analysis reported by Pattnaik *et al.*, revealed the presence of flavonoids, tannins, glycosides, phenols, steroid, saponin, gallic acid and myricetin 3′-rhamnoside-3-galactoside in the leaves [6]. In 2017, Joshi *et al.*, [7] have reported the anti-depressant activity of hydroalcoholic extract of *Buchanania lanzan* fruits. Kodati *et al.*, [8, 9] have reported anti-diarrhoeal and anti-ulcer activity of ethanolic extract of *Buchanania lanzan* Spreng. roots. Tyagi *et al.*, [10] reported *in-vivo* diuretic and anti-ulcer activity in fruits of *Buchanania lanzan*. Methanolic extract of roots of *Buchanania lanzan* Spreng. Were also reported to possess analgesic and anti-inflammatory activities [11].

FIG. 1: *BUCHANANIA LANZAN* SPRENG PLANT

The essential oil obtained from seeds of *Buchanania lanzan* Spreng. was reported to possess antifungal activity [12]. The leaves of *Buchanania lanzan* are also reported to possess several pharmacological activities. In 2011, methanolic extract of leaves of *Buchanania lanzan* was reported to possess adaptogenic activity in an experimental study in rat model [13]. Anti-diabetic, anti-hyperlipidemic and antioxidant activity of the methanol extract of leaves of *Buchanania lanzan* was reported by Sushma *et al.*, in streptozotocin-induced types I and II diabetic rats [14]. As literature survey suggested the presence of variety of phytoconstituents like steroids, tannins, saponins, carbohydrates, alkaloids, and flavonoids in *Buchanania lanzan*, a need was felt to evaluate the plant for its pharmacological activities. Therefore, the present study was carried out with the aim to perform phytochemical screening and evaluation of antibacterial, anti-fungal, anthelmintic and hepatoprotective activities of *Buchanania lanzan* Spreng. leaves.

MATERIALS AND METHODS:

Materials: The leaves of *Buchanania lanzan* were collected from a local area of Manasayurved, Nagpur, Maharashtra, India, in September 2015. A solvent such as petroleum ether, chloroform, ethyl acetate, ethanol was purchased from Loba Chemie Pvt. Ltd. Mumbai.

Methods:

Authentication of *Buchanania lanzan* Spreng. Plant: The plant *Buchanania lanzan* was authenticated by Dr. S. N. Malode, Head of Department of Botany, Government Vidarbha Institute of Science and Humanities, Amravati. The plant has Reference no. GVISH/BOT/Report/ 07/2015. A sample voucher specimen of the plant was deposited for future reference.

Extraction: The leaves of *Buchanania lanzan* was collected and dried in the shade and then pulverized in a grinder. The material was then passed through #120 mesh to obtain uniform size powder. The powdered plant material was successively extracted separately with solvents of increasing polarity like petroleum ether, chloroform, ethyl acetate and ethanol by Soxhlet extractor.

Before extraction with each solvent, the powdered material, as well as each extract (residue), was air-dried below 50 °C, and The completion of extraction was indicated by taking a sample out of siphon tube on TLC plate and placing it in iodine chamber. All the extracts were concentrated under the vacuum, and dried along solvent was distilled off.

Phytochemical Screening: The plant may be considered as the biosynthetic laboratory for a multitude of components like alkaloids, glycoside, volatile oils, tannins, and flavonoids. They are termed as secondary metabolites, which are mainly responsible for therapeutic effects. Various extracts of *Buchanania lanzan* were subjected to phytochemical screening **Table 1** for identification of different constituents and plant metabolites present in the extract [1].

TABLE 1: PRELIMINARY PHYTOCHEMICAL SCREENING OF *BUCHANANIA LANZAN*

Constituents	Test/Reagents	*Buchanania lanzan* extract		
		Chloroform	Ethyl acetate	Ethyl Alcohol
Alkaloids	Hager's reagent	+	-	+
	Wagner's reagent	-	-	-
	Mayer's reagent	-	-	-
	Dragendorff's reagent	-	-	-
Amino acid	Ninhydrin Test	-	-	-
Carbohydrates	Molisch's test	+	+	+
	Bradford' test	+	+	+
Proteins	Biuret test			
	Million's test	–	–	–
	Xanthoprotein test			
Flavonoid	Shinoda test	+	+	+
Steroids	Salkowaski reaction	+	+	+
	Liebermann Burchard test	+	+	+
Tannins	Ferric chloride test	+	+	+
	Lead acetate Test	–	–	–
	Nitric acid test	–	+	+
	Gelatin solution test	+	+	–
Saponin	Foam test		+	+

*(-) indicates absent, (+) indicates present

Evaluation of Pharmacological Activity:

Antibacterial Activity: [15-17] Anti-bacterial activity of *Buchanania lanzan* was evaluated on *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* using paper disc method. Extracts were used at a concentration of 1 mg/ml along with standard antibiotic Ampicillin (1 mg/ml) in dimethyl sulfoxide (DMSO) solution. Test organisms were maintained at nutrient medium (Sabouraud dextrose agar medium) which was sterilized by autoclaving at 151 b/sq. inch pressure for 30 min. All extracts were dissolved in DMSO separately to get 10 mg/ml solution. The nutrient agar plates were prepared by pouring 20 ml of molten media into sterile petriplates under aseptic conditions.

The plates were allowed to solidify for 5 min and 0.5 ml of test culture was inoculated and uniformly spread over the agar surface with the help of a sterile L - shaped bent glass rod. After inoculation, wells were scooped out with 6 mm sterile cork borer and the lids of the dishes were replaced. To each well, different extract solution was added separately and controlled were the same maintained. The treated plats were kept for incubation at 37 °C for 24 h. At the end of incubation, inhibition zones formed around the discs were measured and diameter was calculated in millimeter.

Anti-fungal Activity: [18] Anti-fungal activities of *Buchanania lanzan* leaves extracts was evaluated on *Aspergillus niger*, *Aspergillus flavus* and *Candida albicans* with well diffusion method. Extracts were used at a concentration of 1 mg/ml along with standard antifungal Ketoconazole. Test organisms were maintained at nutrient medium (Sabouraud dextrose agar medium) which was sterilized by autoclaving at 151 b/sq. inch pressure for 30 min. Ketoconazole (1 mg/ml) in DMSO solution. All extracts were dissolved in dimethyl sulfoxide (DMSO) separately to get 10 mg/ml solution. 1 ml of culture mixed thoroughly. The plates were allowed to solidify and dry for 15 min before use in the test. Wells were then created and a pipette was used to place 50 µl of diluted extract into each well. The plates were incubated at 37 °C and 28 °C for 3-5 days after which they were examined for inhibition zones. The calibrated plastic scale was used to measure the inhibition zones. The test experiment was repeated two times to ensure reliability.

Anthelmintic Activity: [19, 20] The anthelmintic activity was evaluated on Indian earthworm *Pheritima posthuma*. The extracts were prepared at a concentration of 10 mg/ml, along with albendazole as a standard anthelmintic. Albendazole (10 mg/ml) prepared in distilled water. The various concentrations (25, 50 mg/ml)

of each extract were prepared in distilled water. Five groups each containing four earthworms of approximately equal size was released into 10 ml of the desired formulation. Each group was treated with one of the following, vehicles (5% DMF in normal saline), albendazole, alcoholic extract, chloroform extract, ethyl acetate extract of leaves of *Buchanania lanzan* (25, 50 mg/ml each) in normal saline containing 5% DMF. The living and viable worms were kept under close observation and the time taken to complete paralysis and death were recorded. The motionless worms were transferred to warm water at 40 °C to confirm that they are dead.

Hepatoprotective Activity: [21-23] Hepatoprotective activity was carried out by an acute toxicity study. Acute toxicity study of successive extracts of chloroform, ethanol and ethyl acetate was performed as per OECD guidelines 423 using Wistar albino rats. The animals were randomly selected and marked to permit individual identification. They were kept in the cage five days before dosing to allow for acclimatization to laboratory conditions. The extract of *Buchanania lanzan* had been given in various doses (100 - 500 mg/kg) by the oral route. After administration of the extract, the animals were observed individually after at least once during the first 30 min, periodically during the first 24 h, with special attention giving during first 4 h, and duly thereafter, for a total 14 days. Data for mortality at different dose levels were recorded.

RESULTS:

Anti-bacterial Activity: Anti-bacterial activity was carried out with the Disc Diffusion method against *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* **Fig. 2**. The chloroform extract of leaves was more effective against *Pseudomonas aeruginosa* with a maximum zone of inhibition 20 mm as compared to standard anti-biotic ampicillin (20 mm) **Table 2.**

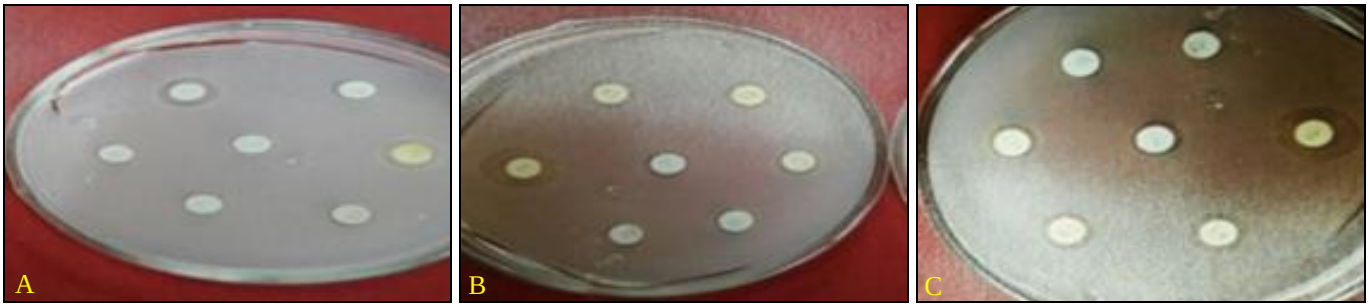

FIG. 2: ANTI-BACTERIAL ACTIVITY AGAINST A) *ESCHERICHIA COLI* B) *PSEUDOMONAS AERUGINOSA*, C) *STAPHYLOCOCCUS AUREUS*

TABLE 2: ANTI-BACTERIAL ACTIVITY OF *BUCHANANIA LANZAN* LEAVES EXTRACT

	Zone of inhibition in mm		
Extracts	***Escherichia coli***	***Pseudomonas aeruginosa***	***Staphylococcus aureus***
Alcoholic extract	12	10	R
Chloroform extract	10	20	9
Ethyl acetate extract	R	R	8
Ampicillin (5 mg/ml)	16	20	20

*R- Resistant (no zone of inhibition)

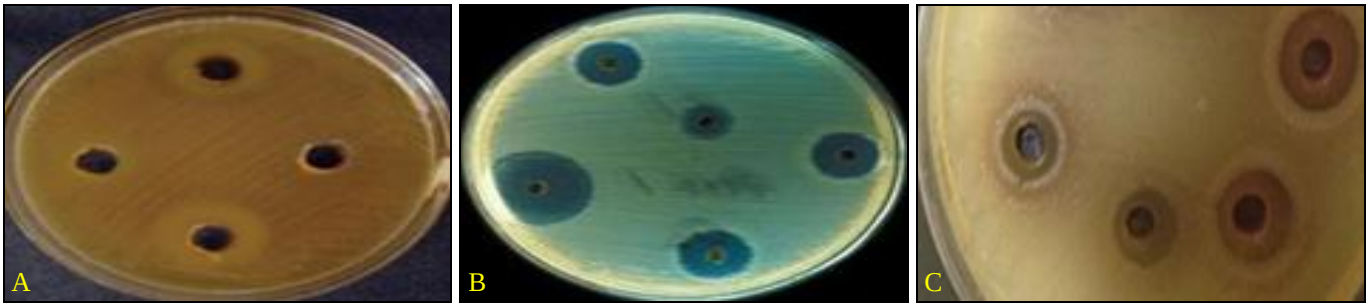

FIG. 3: ANTI-FUNGAL ACTIVITY AGAINST A) *CANDIDA ALBICANS*, B) *ASPERGILLUS NIGER*, C) *ASPERGILLUS FLAVUS*

TABLE 3: ANTI-FUNGAL ACTIVITY OF *BUCHANANIA LANZAN* LEAVES EXTRACT

Extracts	Zone of inhibition (mm)		
	Candida albicans	*Aspergillus flavus*	*Aspergillus niger*
Alcoholic extract	14	12	12
Chloroform extract	20	22	22
Ethyl acetate extract	R	8	8
Ketoconazole (1mg/ml)	22	22	24

*R- Resistant (no zone of inhibition)

Anti-fungal Activity: Antifungal studies were carried out using well diffusion method against *Candida albicans*, *Aspergillus niger*, and *Aspergillus flavus* **Fig. 3**. The chloroform extract was found to be more effective against *Aspergillus niger* with a zone of inhibition 22 mm compared with standard anti-fungal ketoconazole (22 mm) as shown in **Table 3**. Acetone extract has shown the zone of inhibition of 22 mm against *Aspergillus flavus* compared to standard ketoconazole (22 mm).

Hepatoprotective Activity: Hepatoprotective activity was evaluated by acute toxicity study as per OECD guidelines 425 using Wistar albino rats using three successive extracts of acetone, chloroform and ethanol were performed **Table 4**. The effect of these extracts on serum cholesterol on CCL_4 in hepatotoxicity in rats was studied by using SGOT (Serum Glutamate Oxaloacetate Trans-aminase), SGPT (Serum Glutamate Peroxides Transaminase), and ALP (Alkaline Phosphates) compared with standard Liv 52 **Fig. 4**. The evaluation of hepatoprotective activity revealed that acetone extract was less effective than other extracts in hepatotoxic rats.

TABLE 4: EFFECT OF VARIOUS EXTRACTS OF *BUCHANANIA LANZAN* LEAVES (CHLOROFORM, ETHYL ACETATE AND ALCOHOL) ON SGOT (U/L), SGPT (U/L), ALP (IU/L) AND BILIRUBIN (MG/DL) IN CCl_4 INDUCED LIVER DAMAGE

Group	Treatment	SGOT (U/L)	SGP (U/L)	ALP (IU/L)	Total Bilirubin (mg/dl)
I	Control	192.3 ± 3.05	78 ± 7.5	232.7 ± 7.5	0.74 ± 0.07
II	Toxic	335.3 ± 5.03	352 ± 9.1	489.0 ± 9.0	0.88 ± 0.025
III	CCl_4 + Std	159.3 ± 5.03	115 ± 4.5	222.0 ± 7.0	0.5433 ± 0.04
IV	Alcoholic extract 100 mg/kg	214.3 ± 4.04	129.3 ± 4.04	344.7 ± 5.0	0.5533 ± 0.035
IV	Alcoholic extract 300 mg/kg	224.7 ± 4.50	117.7 ± 2.5	265.7 ± 6.0	0.7967 ± 0.045
VI	Chloroform extract 100 mg/kg	245.0 ± 4.35	91.33 ± 4.04	294.3 ± 4.04	0.6433 ± 0.04
VII	Chloroform extract 300 mg/kg	255 ± 5.0	161.3 ± 4.16	234.3 ± 4.0	0.7667 ± 0.05
VIII	Ethyl acetate 100 mg/kg	251.3 ± 6.5	130.7 ± 5.50	214.7 ± 5.03	0.6533 ± 0.045
IX	Ethyl acetate 300 mg/kg	174.3 ± 4.04	64.33 ± 4.04	290.3 ± 2.5	0.6167 ± 0.035

Student's t-test was performed. Each value represents the mean ± S.E.M. of 5 rats in each group. P values :< 0.05 as compared with group II (CCl_4 treated group)

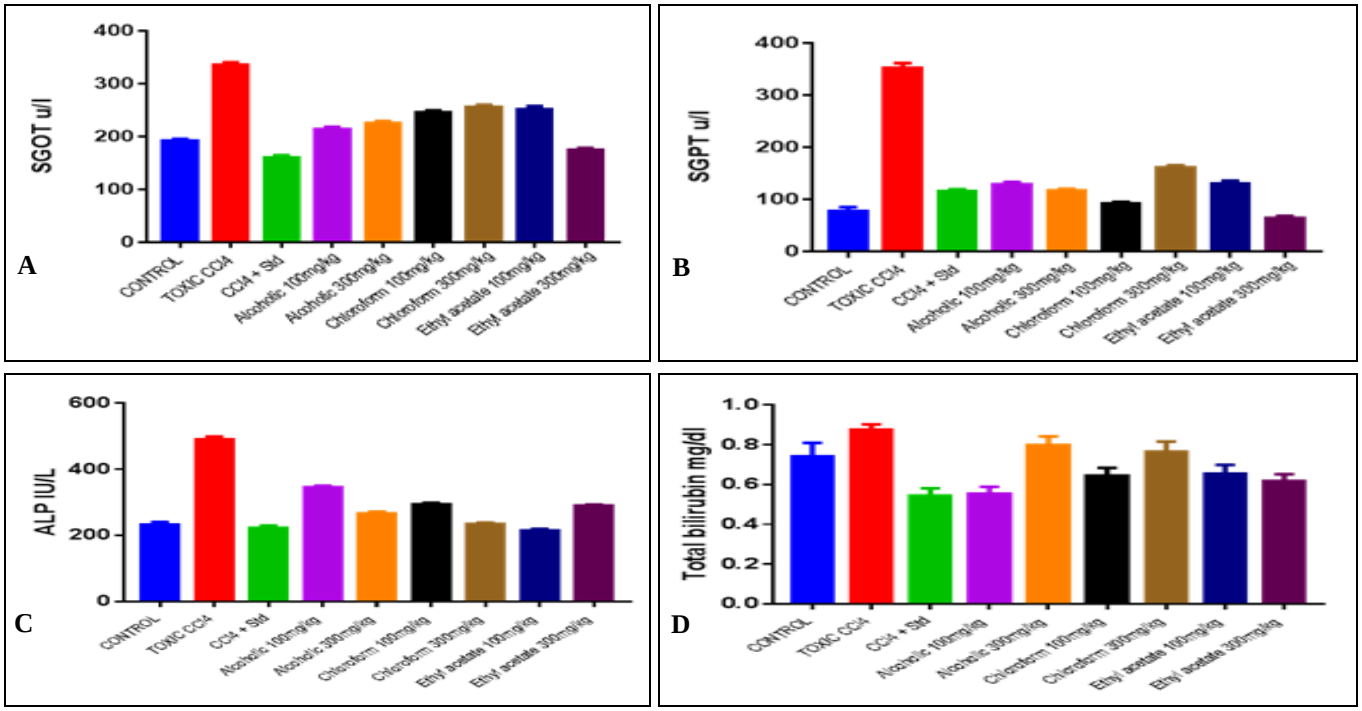

FIG. 4: LEVEL OF A) SGOT, B) SGPT, C) ALP, D) BILIRUBIN IN GROUPS I-IX IN CCL4 INDUCED LIVER DAMAGE

Anthelmintic Activity: Anthelmintic activity **Fig. 5** showed that alcoholic extract was more effective as it takes less time for paralysis and death of earthworms in **Table 5**.

TABLE 5: EFFECT OF *B. LANZAN* EXTRACT OF VARIOUS CONCENTRATIONS ON EARTHWORM

Test Substance	Concentration (mg/ml)	Time is taken by Pheretima Posthuma for paralysis (P) and Death (D) of worms in minutes	
		P	D
Alcoholic extract	25	27	40
	50	18	34
Chloroform extract	25	38	53
	50	28	45
Ethyl acetate extract	25	30	52
	50	20	40
Standard Albendazole	25	14	28

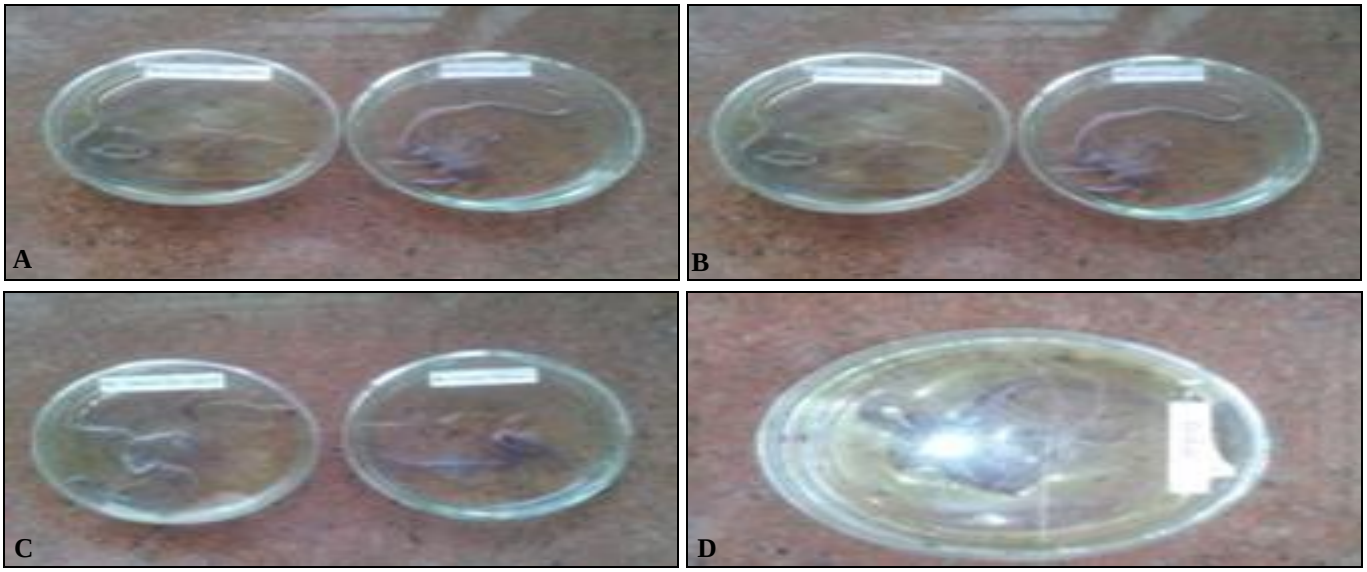

FIG. 5: EARTHWORMS IN A) ALCOHOLIC EXTRACT, B) ETHYL ACETATE EXTRACT, C) CHLOROFORM EXTRACT, D) ALBENDAZOLE

DISCUSSION: Present research work aimed to evaluate potential hepatoprotective, antibacterial, antifungal and anthelmintic activity of extracts of *Buchanania lanzan* leaves. As per our knowledge, the plant has not been explored for its hepatoprotective activity to date. The literature survey reveals that the *Buchanania lanzan* contains tannins, saponins, flavonoids, carbohydrates which are known to possess anti-oxidant, antimicrobial activity. The anti-bacterial study was performed using disc diffusion method. The zone of inhibition against various bacterial strains is shown in **Table 2**. The results reveal that chloroform extract is more effective against *Pseudomonas aeruginosa* with maximum zone of inhibition 20 mm. Alcoholic extract was resistant to *Staphylococcus aureus* while ethyl acetate extract was resistant to *Escherichia coli* and *Pseudomonas aeruginosa*. The results of anti-fungal activity are shown in **Table 3**. It reveals that chloroform extract and alcoholic extract had antifungal activity against all fungal strains. However, ethyl acetate extract was found to be less active as anti-fungal. Assessment of hepatoprotective activity, the degree of hepatotoxicity developed was determined by withdrawing blood and evaluating different parameters on seventh day. The elevated level of SGOT, SGPT, ALP, and total bilirubin indicates the hepatotoxicity. According to observed biochemical parameters obtained **Table 4**, ethyl acetate extract showed a marked reduction in elevated enzyme level, and it shows activity like Liv52 standard drug **Fig. 4**. It can be concluded that ethyl acetate extract was effective in hepatotoxicity. The anthelmintic study was performed on Indian earthworm *Pheritima posthuma* using Albendazole as a standard drug. According to results showed in **Table 5**, the alcoholic extract showed more anthelmintic activity as compared to ethyl acetate and chloroform extracts.

CONCLUSION: The antibacterial, antifungal, the anthelmintic and hepatoprotective activity of *Buchanania lanzan* leaves extract was evaluated. The ethyl acetate extract of *Buchanania lanzan* leaves was found to be active as a hepatoprotective. The plant exhibited an antibacterial effect against *Escherichia coli*, *Pseudomonas aeruginosa,* and *Staphylococcus aureus*. Antifungal effect against *Candida albicans*, *Aspergillus flavus*, *Aspergillus niger*. Moreover, the leaves extract also exhibited moderate anthelmintic activity. Therefore, it can be concluded that *Buchanania lanzan* leaves possess hepatoprotective, anti-bacterial, anti-fungal and anthelmintic activity.

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CONFLICTS OF INTEREST: The authors declare no conflict of interest.

REFERENCES:

1. Siddiqui MZ, Chowdhury AR, Prasad N and Thomas M: *Buchanania lanzan* : a species of enormous potentials. World J of Pharmaceutical Sciences 2014; 2: 374-79.
2. Rai PK, Sharma DR and Sharma A: *Buchanania lanzan* is a pharmacognostic miracle herb. Research Journal of Pharmacognosy and Phytochemistry 2015; 7: 182-86.
3. Duke JA and Duke JA: *Buchanania lanzan* Spreng. (Anacardiaceae) chirauli nut, cuddapah almond, cheronjee, chironjii, almondette. CRC Hand of Nuts 2018; 57-58.
4. Mehta SK, Mukherjee S and Jaiprakash B: Preliminary phytochemical investigation on leaves of *Buchanania lanzan* (Chironji). International Journal of Pharmaceutical Sciences Review and Research 2010; 3: 55-9.
5. Gupta RK, Tyagi YK and Khatoon N: Nutraceutical potential and phytochemical screening of *Buchanania lanzan*, an underutilized exotic Indian nut and its use as a source of functional food. Journal of Pharmacognosy and Phytochemistry 2015; 4: 87-94.
6. Pattnaik A, Sarkar R, Sharma A, Yadav KK, Kumar A, Roy P, Mazumder A, Karmakar S and Sen T: Pharmacological studies on *Buchanania lanzan* Spreng. - A focus on wound healing with particular reference to anti-biofilm properties. Asian Pacific J of Tropical Biomedicine 2013; 3: 967-74.
7. Joshi A, Soni P, Vyas N, Khan J, Malviya S and Kharia A: Anti-depressant activity of hydroalcoholic extract of *Buchanania lanzan*. European Journal of Biomedical and Pharmaceutical Sciences 2017; 4: 800-03.
8. Kodati D, Pareta SK and Patnaik A: Anti-diarrhoeal activity of alcoholic extract of *Buchanania lanzan* Spreng. roots. Pharmacology Online 2010; 3: 720-26.
9. Kodati D, Pareta, SK and Patra KC: Anti-ulcer activity of ethanolic extract of *Buchanania lanzan* Spreng. roots. Annals of Biological Research 2010; 1: 234-39.
10. Tyagi CK, Tripathi A, Singh G, Chandekar A and Sahu S: *In-vivo* diuretic and anti-ulcer activity in fruits of *Buchanania lanzan*. International Journal of Phytomedicine 2017; 9: 673.
11. Pattnaik AK, Kodati D, Pareta SK, Patra KC and Harwansh RK: Analgesic and anti-inflammatory activities of *Buchanania lanzan* Spreng. roots. Research Journal of Pharmaceutical, Biological and Chem Sci 2011; 2: 419-25.
12. Allapure RB: Anti-fungal properties of *Buchanania lanzan* essential oil against groundnut seed mycoflora. World Journal of Pharmaceutical Research 2017; 6: 1010-13.
13. Mehta SK, Nayeem N and Bains N: Adaptogenic activity of methanolic extract of *Buchanania lanzan* leaves an experimental study in rat model. Der Pharmacia Sinica 2011; 2: 107-12.
14. Sushma N, Smitha PV, Gopal YV, Vinay R, Reddy NS, Mohan M and Raju B: Anti-diabetic, antihyperlipidemic and antioxidant activities of *Buchanania lanzan* spreng methanol leaf extract in streptozotocin-induced types I and II diabetic rats. Tropical J of Pharmaceutical Research 2013; 12: 221-26.
15. Dhabale P: Phytochemical and pharmacological screening of selected medicinal plants, thesis submitted to Sant Gadge Baba Amravati University, Government College of Pharmacy, Amravati 2013; 1-3.
16. Bose S and Bose A: Anti-microbial activity of *Acanthus ilicifolius* (L.). Ind J of Pharm Sciences 2008; 70: 821-23.
17. Valgas C, De Souza SM, Smânia EFA and Smânia A: Screening methods to determine antibacterial activity of natural products. Brazilian J of Micro 2007; 38: 369-80.
18. Manore D, Pillai S, Joshi A and Punashiya R: Preliminary phytochemical screening and antibacterial activity of ethyl acetate extract of *Cuscuta reflexa* Roxb. Research Journal of Pharmacy and Technology 2012; 5: 79-82.
19. Ahirrao RA: *In-vitro* anthelmintic property of various herbal plants extracts against *Pheritima posthuma*. Pharmacology Online 2011; 2: 542-47.
20. Partap S, Kumar S, Kumar A, Sharma NK and Jha KK: *In-vitro* anthelmintic activity of *Luffa cylindrica* leaves in Indian adult earthworm. Journal of Pharmacognosy and Phytochemistry 2013; 3: 135-37.
21. OECD: Guidance document on acute oral toxicity testing. Environmental Health and Safety Monograph Series on Testing and Assessment No. 24, 2000.
22. Patwardhan S, Vadnal P, Singhai AK and Somani R: Studies on hepatoprotective activity of ethanolic extract of *Cassia fistula* bark against CCl_4 induced hepatic damage in wistar rats. Pharmacologyonline 2009; 2: 50-63.
23. Srillakshmi VS, Vijayan P, Raj PV, Dhanaraj SA and Chandrashekhar HR: Hepatoprotective properties of *C. sappan* Linn. heartwood on carbon tetrachloride-induced toxicity. Indian J of Experimental Biology 2010; 48: 905-10.

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