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ANTIBACTERIAL PROPERTIES OF TRADITIONALLY USED MEDICINAL PLANTS FOR ENTERIC INFECTIONS BY ADIVASI's (BHUMKA) IN MELGHAT FOREST (AMRAVATI DISTRICT)

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ABSTRACT

Medicinal plants are a major source of therapeutic agents since time immemorial. Tribal and rural community from their parents on folklore medicines acquires incredible knowledge of phytomedicine in non-coded form. With the repeated discussions and consultations with Tribal and Bhumkas, we selected 36 different medicinal plants of 30 families used against enteric infections form Melghat forest (Amravati district). Antibacterial activity with extracts prepared in aqueous, ethanol, methanol, and acetone was performed by disk diffusion method against bacterial enteric pathogens such as *E. coli*, *S. aureus, E. aerogenes*, *Ps. aeruginosa*, *S. typhi*, *S. typhimurium*, *S. paratyphi, Pr. vulgaris*, *K. pneumoniae* and *Sh. flexneri. Acacia arabica* leaves proved strong antibacterial against *E. coli, S. aureus, E. aerogenes, Sh. flexneri, S. paratyphi* and *S. typhi.* In *Terminalia chebula* fruits and *Terminalia bellirica* fruits strong antibacterial potential was observed against *E. coli, E. aerogenes, Ps. aeruginosa* and *S. typhimurium.* Phytochemical analysis showed presence of fats, oils, alkaloids, cardiac glycosides, anthraquinones, tannins, and phenolics.

INTRODUCTION: Melghat forest is part of Amravati district of Maharashtra State (India) and it preserves innumerable valuable medicinal plants. The knowledge of these medicinal plants passed traditionally from one generation to other without documentation [1]. Korkus, Bhumka, or Bhagats traditionally used plants for the treatments of diarrhea, dysentery, stomachache, and any other enteric disorder but their antibacterial potential were not documented [2]. Almas [3], demonstrated antibacterial potential of Babul; Lavhale and Mishra [4] claimed antitumor, antileukemic antifeedant activities of quassinoids in *Ailanthus excelsa*; Rani and Khullar [5] showed moderate antibacterial activity of aqueous and methanol extracts of *Embelia ribes, Caesalpinia bonducell* and Dwivedi *et al* [6] studied antibacterial, antimalerial activity of *Caesalpinia bonducella* seeds. Aqueous, ethanol and methanol extracts of Nut grass studied by Jha *et al* [7] while Shivkumar *et al* [8] demonstrated its anticonvalscent activity. Loizzo *et al* [9], Dellagalli *et al* [10] and Shemali *et al* [11] studied the antihypertensive, antimalerial and antibacterial (ethyl acetate extract, 6mg/disc) properties of bark of *Ailanthus excelsa.* Jain *et al* [12] studied the antimicrobial activities of *Embelia ribes* in *Piper longum.* Diarex, an herbal formulation against non-specific diarrhea, containing *Tinospora cordifolia* is an effective drug [13].

Despite of the numerous advances in medicine, the prevalence of infectious diseases continues to rise due to emergence of antibiotic resistant pathogens, which are attributed to the widespread use of antibiotics. Search for new antibacterial agents from plants has now a day gained an importance. The interest primarily has arisen from the belief that green medicine is safe and dependable, compared to with costly synthetic drugs that can have adverse effects. Therefore, the objective of this study was to screen medicinal plants from Melghat forest for antibacterial potential against different enteric pathogens by scientific experimentation. Search of new antimicrobials against upcoming resistant strains of pathogens was another objective in present work. With the repeated discussions and consultations with Bhumkas, we selected 36 different medicinal plants of 30 families used against enteric infections (Table 1).These plants are studied by different researchers in various other regions but not from Melghat against enteric pathogens were not studied. Hence, we selected herbal plants from Melghat used by Korkus against various enteric infections for our study. The present attempt was to compile scientific updated information on various aspects of medicinal plant from Melghat. The medicinal plants used by Korku in Melghat traditionally against enteric diseases were selected based on interactions with Bhumkas, Bhagats, and previous survey studies [14, 15, 16] and literature available in Ayurveda.

MATERIALS AND METHODS:

Selection of Medicinal plants and preparation of extracts: With help of traditional herbal healer (Korkus or Bhumka or Bhagats of Melghat forest), we identified 40 medicinal plants, (**Table 1**), which are used by these people against diarrhoeal or abdominal discomforts or intestinal infections. R. B. Giri[1], Range Forest Officer, Maharashtra Forest Rangers College, Chikhaldara identified these plants. Selected plant's parts collected, cleaned and disinfected with water and mercuric chlorides (0.5%), dried in shadow and ground to powder in grinder mixer. A 10 g of powder was soaked in 100 mL of solvent (water, ethanol, methanol, and acetone), refluxed in soxlet apparatus, filtered and filtrate was evaporated in controlled conditions of temperature to avoid destruction of dissolved phytochemicals.

TABLE 1: MEDICINAL PLANTS AND THEIR PARTS USED BY BHUMKAS FOR TREATMENT OF VARIOUS ENTERIC INFECTIONS

Botanical name	Parts used	Medicinal use by Korkus
Abelmoschus manihot	Root	Juice in dysentery, bark is emmenogogue
Acacia arabica	Leaves	Diarrhea, upper respiratory tract infection, urinary tract infections
Acacia leucopholea	Bark	Boils, ulcers, aphrodisiac, antisyphilitic, antibacterial, antihelmintic
Aegle marmelos	Leaves	Antiseptics, digestive, stomachic
Ailanthus excelsa	Bark	Tonic, expectorant, chronic bronchitis
Aloe barbandensis	Leaves	Liver disorders, rheumatism, skin disorders
Astercantha longifolia	Seeds	Diuretics, jaundice, rheumatism and diseases of urino-genital tract
Butea monosperma	Flower	Astringent, diuretic, depurative, aphrodisiac and tonic
Butea monosperma	Seeds	To cure leprosy wounds, aperients and rubefacient.
Caesalpinia bonducella	Seeds	Diuretic and antipyretic, diarrhea, cerebral hemorrhages
Cassia fistula	Pods	Laxative, tonic and antidysenteric properties
Cocculus hirsutus	Root	Juice of leaves externally used for eczema, prurigo and Impetigo
Cymbopogon martinii	Whole plant	Cardiotonic, galactogogue, sudorific, febrifuge, neuralgia, bronchitis, leprosy
Cyperus rotundus	Rhizomes	Diarrhea, indigestion, cholera dysentery, fever, leprosy, skin diseases, colic pains, dyspepsia
Daemia extensa	Leaves	Hemorrhages, colitis, fever, skin infection
Eclipta prostrata	Whole plant	Against enlargement of liver, spleen, skin diseases, purgative, antifungal activity
Embelia ribes	Seeds	Fever, diseases of chest and skin, antihelmintic, skin diseases, leprosy
Embilica officinalis	Fruits	Dried fruit powder is given in diarrhea, dysentery, hemorrhages, anemia,
Exacum pedunculatum	Whole plant	Decoction of root and leaves as febrifuge, bitter tonic, antihelmintic
Ficus hispida	Fruits	Tonic, lactogogue, emetic, purgative, rheumatism
Gardenia gummifera	Resin	Given to children in nervous disorders, diarrhea, clean foul ulcers, fever
Helicteres isora	Fruits	Dried fruits in intestinal disorders, colic pains, flatulence, diarrhea
Holarrhena antidysenterica	Bark	Stem bark in dysentery, ant-stomachic, febrifuge, amoebic dysentery, colic pain
Listea glutinosa	Bark	Demulcent, emollient, antispasmodic, wounds
Madhuca indica	Bark	Decoction for rheumatism, bleeding and spongy gums
Maytenus emerginata	Leaves	Vermifuge, toothache, applied on sores, anticancer
Maytenus emerginata	Root	Gastrointestinal troubles, dysentery
Mentha sylvestris	Leaves	Carminative, antiseptic, stimulant, digestive disorders, relieves pain
Moringa oleifera	Leaves	Against scurvy, catarrhal affections, wounds, antiseptics
Rauvolfia serpentina	Root	Tranquillizers, anti-inflammatory,
Solanum nigrum	Whole plant	Antiseptic, antidysenteric properties, jaundice, cure disorders of liver
Sphaeranthus indicus	Fruits	Antihelmintic, antacid, liver disorders
Sphaeranthus indicus	Whole plant	Juice is styptic, useful in liver disorders, decoction in chest pains, cough and bowel complaints
Syzgium cumuni	Leaves	Good source of iron, asthma, bronchitis, diabetes, dysentery, diarrhea
Terminalia bellirica	Fruits	Stomach disorders, diarrhea, piles, leprosy, dropsy, headache, fever
Terminalia chebula	Fruits	Chronic ulcers, wounds, astringent, laxative, diarrhea, blood purifier
Tinospora cordifolia	Stem	Antiallergic, antidiabetic, antihepatotoxic, antipyretic, anti-inflammatory and anticancer
Ventialago madraspatna	Bark	Stomachic, tonic, dyspepsia, fever
Woodfordia fruticosa	Flower	Flowers cause alcoholic fermentations, bowel complaints, antipyretic, cleaning ulcers disorders of mucous membrane
Woodfordia fruticosa	Root	Colic pains, hemorrhoids and derangement of liver

Bacterial cultures: The standard pathogenic bacterial cultures procured from IMTECH, Chandigarh, India and used in the present study. The bacteria rejuvenated in Mueller-Hinton broth (Hi-media laboratories, Mumbai, India) at 37^0C for 18 hours and then stocked at 4^0C in Mueller-Hinton Agar. Subcultures were prepared from the stock for bioassay. A loopful of culture inoculated in 10 mL of sterile nutrient broth and incubated at 37^0 C for 3 hours. Turbidity of the culture standardized to 10^5 CFU with the help of SPC and Nephlo-turbidometer.

Agar gel diffusion antibacterial activities: For antibacterial properties, 0.1 ml bacterial suspension of 10^5 CFU ml^{-1} was uniformly spread on Mueller-Hinton Agar (MHA) plate to form lawn cultures. The various organic extracts of acetone, ethanol, and methanol were prepared in dimethyl sulfoxide (DMSO) at the concentration of 20 mg ml^{-1}.

Well diffusion technique: Screening of antibacterial activity was performed by well diffusion technique the MHA plates were seeded with 0.1 ml of the standardized inoculums of each test organism. The inoculum was spread evenly over plate with loop or sterile glass spreader. A standard cork borer of 10 mm diameter was used to cut uniform wells on the surface of the MHA and 100 µl of each crude and organic extracts of *E. officinalis, T. chebula and T. bellerica* was introduced in the well.

Paper disc agar diffusion method: Sterile Whatman filter paper discs (10 mm) were soaked with each aqueous and organic extracts. Each Whatman filter paper disc (10 mm diameter) was impregnated with 10 mg per disc of residue. Both wet and dry discs (dried at 37^0C overnight) applied to the surface of MHA plates seeded with 3-h broth culture of the tested bacteria. The plates then incubated for 18 h at 37^0C. Antibiotic susceptibility discs ampicillin 10µg used as positive control while disc soaked in various organic solvents and dried placed on lawns as negative control. The antibacterial activity evaluated by measuring the diameter of inhibition zone. The experiment performed in duplicate and the mean of the diameter of the inhibition zones was calculated.

Photochemical analysis: The presence of saponins, tannins, anthraquinones, alkaloids, triterpens, flavonoids, glycosides, reduced sugar, and phlobatannins were detected by simple qualitative methods [17].

Antibacterial Activities: Anticlerical activities were calculated as antibacterial sensitivity index (ASI) as under:

$$\text{ASI of Plants} = \frac{\text{Total score of antibacterial response}}{\text{Number o f pathogens X number of different concentration tested X number of extracts tested}}$$

Note: Total score = sum of diameter of zone of inhibition obtained in all four solvent extracts of medicinal plant.

RESULT AND DISCUSSIONS: In all 40 medicinal plant samples were extracted in four different solvents. Hence, total 160 extracts were tested against 10 different enteric pathogens. Qualitative analysis of all these extracts was performed to detect presence of different phytochemicals. Out of 40 samples, 16 were reported strong antibacterial, which have been discussed in details. The remaining samples were either moderate or mild antibacterial to the test pathogens. Among forty aqueous extracts, five extracts showed strong antibacterial response, seven moderate and seventeen with mild antibacterial potential. Strong antibacterial (ASI 19-12) response was observed in aqueous extracts of *Aegle marmelos, Helicteres isora, Terminalia chebula, Terminalia bellirica* and *Embilica officinalis* (**Table 2**).

TABLE 2: ANTIBACTERIAL ACTIVITIES OF MEDICINAL PLANTS (DIAMETER OF ZONE OF INHIBITION OF GROWTH IN MM. (CONCENTRATION 10MG/DISC)

Botanical name	Family	part used	Solvent	*E. coli*	*S.aureus*	*E. aerogenes*	*Ps. aeruginosa*	*S. typhi*	*S. typhimurium*	*S. paratyphi*	*Pr. vulgaris*	*K. pneumoniae*	*Sh. flexneri*	Reducing sugars	Proteins	Fats and oil	Steroids	Cardiac glycosides	Anthraquinones glycosides	Flavonoids	Alkaloids	Tannins and phenolics
Acacia leucopholea	*Mimosaceae*	bark	E	18	25	0	0	16	16	0	20	15	22	+	-	-	+	+	+	+	-	+
Acacia leucopholea	*Mimosaceae*	bark	M	20	24	21	21	17	20	22	22	16	22	+	-	-	+	+	+	+	-	+
Acacia arabica	*Mimosaceae*	leaves	E	17	17	18	13	21	15	25	20	16	25	+	-	-	+	+	+	+	+	+
Acacia arabica	*Mimosaceae*	leaves	M	22	25	22	18	26	15	20	23	17	24	+	-	+	+	+	+	+	+	+
Acacia arabica	*Mimosaceae*	leaves	A	21	24	18	15	23	15	15	21	16	21	+	-	+	+	+	+	+	+	+
Aegle marmelos	*Rutaceae*	leaves	W	23	19	17	19	19	19	17	20	18	17	+	-	-	+	-	+	+	+	+
Aegle marmelos	*Rutaceae*	leaves	E	17	13	14	16	18	18	19	18	16	15	+	-	-	+	-	+	+	+	+
Aegle marmelos	*Rutaceae*	leaves	M	15	16	19	12	18	17	17	17	17	14	+	-	+	+	-	+	+	+	+
Aegle marmelos	*Rutaceae*	leaves	A	15	16	14	12	20	14	0	0	0	0	+	-	+	+	+	+	+	-	+
Butea monosperma	*Papilionaceae*	flowers	W	0	14	15	20	15	0	0	0	0	0	-	-	-	-	-	-	+	-	+
Butea monosperma	*Papilionaceae*	flowers	E	20	18	17	20	20	17	20	17	17	22	-	-	-	-	-	+	+	+	+
Butea monosperma	*Papilionaceae*	flowers	M	16	14	14	14	0	0	0	14	15	0	-	-	-	-	-	+	+	+	+
Butea monosperma	*Papilionaceae*	flowers	A	14	14	0	0	14	17	0	15	15	0	-	-	-	-	-	+	+	+	+
Caesalpinia bonducella	*Caesalpiniaceae*	seeds	E	0	14	18	0	0	0	15	0	0	22	-	+	+	-	+	+	-	+	-
Caesalpinia bonducella	*Caesalpiniaceae*	seeds	M	0	34	33	0	0	0	16	0	0	22	-	+	+	-	+	+	-	+	-
Caesalpinia bonducella	*Caesalpiniaceae*	seeds	A	0	13	16	0	0	0	14	0	14	16	+	+	+	-	+	+	-	+	-
Embilica officinalis	*Euphorbiaceae*	fruits	W	16	14	16	18	0	16	0	16	0	25	+	+	+	+	-	+	+	+	+
Embilica officinalis	*Euphorbiaceae*	fruits	E	16	16	17	16	23	19	19	17	15	22	+	+	+	+	-	+	+	+	+
Embilica officinalis	*Euphorbiaceae*	fruits	M	20	15	21	19	24	26	19	19	0	15	+	+	+	+	-	+	+	+	+
Embilica officinalis	*Euphorbiaceae*	fruits	A	20	15	20	23	29	27	17	17	0	20	+	+	+	+	-	+	+	+	+
Gardenia gummifera	*Rubiaceae*	resin	W	0	0	14	0	0	0	14	0	16	0	-	-	+	+	+	+	+	+	+
Gardenia gummifera	*Rubiaceae*	resin	E	0	19	20	0	0	0	0	0	22	0	-	-	+	+	+	+	+	+	+
Gardenia gummifera	*Rubiaceae*	resin	M	0	22	20	0	0	0	0	0	21	0	-	-	+	+	+	+	+	+	+
Gardenia gummifera	*Rubiaceae*	resin	A	0	21	20	0	0	0	0	0	20	0	-	-	+	+	+	+	+	+	+
Helicteres isora	*Sterculiaceae*	fruits	W	20	16	18	18	16	18	17	23	19	20	+	+	-	+	-	+	-	+	+
Maytenus emerginata	*Celastraceae*	leaves	E	17	18	18	0	17	16	15	20	20	15	+	-	+	+	-	+	+	+	+
Maytenus emerginata	*Celastraceae*	leaves	M	0	16	0	0	0	0	0	0	0	0	+	-	+	+	-	+	+	+	+
Maytenus emerginata	*Celastraceae*	leaves	A	15	18	15	0	0	15	0	0	0	16	+	-	+	+	-	+	+	+	+
Maytenus emerginata	*Celastraceae*	root	E	14	17	17	20	16	17	0	30	15	14	+	-	+	+	+	+	+	+	-
Maytenus emerginata	*Celastraceae*	root	M	15	18	0	0	0	15	0	16	15	15	+	-	+	+	+	+	+	+	-
Maytenus emerginata	*Celastraceae*	root	A	15	19	15	0	17	14	0	14	0	18	+	-	+	+	+	+	+	+	-

Sphaeranthus indicus	*Asteraceae*	WP	W	0	0	15	0	0	14	0	14	0	0	+	-	+	+	-	-	+	+	-
Sphaeranthus indicus	*Asteraceae*	WP	E	15	26	18	14	13	16	26	15	24	22	+	-	+	+	-	+	+	+	-
Sphaeranthus indicus	*Asteraceae*	WP	M	14	0	14	0	0	0	0	16	0	0	+	-	+	+	-	+	+	+	-
Sphaeranthus indicus	*Asteraceae*	WP	A	0	0	15	0	0	0	0	14	14	0	+	-	+	+	-	+	+	+	-
Sphaeranthus indicus	*Asteraceae*	fruits	E	16	30	16	17	15	18	0	20	19	29	+	-	+	+	-	+	+	+	+
Sphaeranthus indicus	*Asteraceae*	fruits	M	15	27	15	14	17	16	0	16	16	25	+	-	+	+	-	+	+	+	+
Syzgium cumuni	*Myrtaceae*	leaves	W	20	19	0	18	15	14	0	0	0	0	+	+	+	+	-	+	+	+	+
Syzgium cumuni	*Myrtaceae*	leaves	E	16	16	0	18	17	12	15	0	0	0	+	+	+	+	-	+	+	+	+
Syzgium cumuni	*Myrtaceae*	leaves	M	15	19	0	14	19	12	17	0	0	0	+	+	+	+	-	+	+	+	+
Syzgium cumuni	*Myrtaceae*	leaves	A	17	17	17	13	13	16	0	0	0	0	+	+	+	+	-	+	+	+	+
Terminalia bellirica	*Combretaceae*	fruits	W	13	15	16	17	13	14	15	13	0	15	+	+	+	+	+	+	+	+	+
Terminalia bellirica	*Combretaceae*	fruits	E	19	13	19	17	16	16	15	17	19	17	+	+	+	+	+	+	+	+	+
Terminalia bellirica	*Combretaceae*	fruits	M	24	25	21	24	13	20	19	13	16	19	+	+	+	+	+	+	+	+	+
Terminalia bellirica	*Combretaceae*	fruits	A	23	24	26	21	17	27	27	18	17	0	+	+	+	+	+	+	+	+	+
Terminalia chebula	*Combretaceae*	fruits	W	16	16	15	18	21	20	0	20	15	15	+	+	+	+	+	+	+	+	+
Terminalia chebula	*Combretaceae*	fruits	E	17	17	23	0	15	17	16	19	17	17	+	+	+	+	+	+	+	+	+
Terminalia chebula	*Combretaceae*	fruits	M	18	16	22	18	20	18	15	16	14	21	+	+	+	+	+	+	+	+	+
Terminalia chebula	*Combretaceae*	fruits	A	19	19	15	16	14	16	17	18	16	20	+	+	+	+	+	+	+	+	+
Woodfordia fructicosa	*Lythraceae*	flower	W	0	15	20	15	0	0	0	15	17	0	+	-	+	+	+	-	+	+	+
Woodfordia fructicosa	*Lythraceae*	flower	E	16	25	14	20	14	14	0	23	17	19	+	-	-	+	+	+	+	-	+
Woodfordia fructicosa	*Lythraceae*	flower	M	14	22	17	24	0	24	18	23	16	21	+	-	-	+	+	+	+	-	+
Woodfordia fructicosa	*Lythraceae*	root	E	15	21	15	18	17	16	21	19	15	19	+	-	-	+	+	+	+	+	+
Woodfordia fructicosa	*Lythraceae*	root	M	0	13	0	0	16	16	14	13	0	0	+	-	-	+	+	+	+	+	+
Ciprofloxacin 10µg				15	25	16	17	16	18	17	15	17	18									

Note: where A=Acetone, E= Ethanol, M= Methanol, W= Aqueous extract, WP= Whole plant

Among forty ethanol extracts, twenty were strong antibacterial, nine moderate and nine mild antibacterial. Strong antibacterial (ASI 19-12) response was observed in ethanol extracts of *Sphaeranthus indicus* whole plant*, Butea monosperma, Acacia arabica, Embilica officinalis, Sphaeranthus indicus* fruit*, Woodfordia fruticosa* flower*, Terminalia bellirica, Aegle marmelos, Woodfordia fruticosa* root*, Maytenus emerginata* leaves*, Terminalia chebula, Maytenus emerginata* root*, Abelmoschus manihot, Moringa oleifera, Madhuca indica, Acacia leucopholea, Listea glutinosa, Ficus hispida, Solanum nigrum, Eclipta prostrata.* Among forty methanol extracts, nine were strong antibacterial, eleven were moderate, and seventeen were mild antibacterial. Strong antibacterial (ASI 22-14) response was observed in methanol extracts of *Acacia arabica, Acacia leucopholea, Terminalia bellirica, Woodfordia fruticosa, Embilica officinalis, Terminalia chebula, Aegle marmelos, Sphaeranthus indicus* fruit and *Abelmoschus manihot.* Among all the forty

samples of acetone extracts four were strong antibacterial, nine were moderate and twenty-two were mild antibacterial. Strong antibacterial (ASI 20-14) response was observed in acetone extracts of *Terminalia bellirica, Acacia arabica, Embilica officinalis* and *Terminalia chebula* (Table 2). Bhumkas use *Terminalia bellirica* fruits to increase digestion of food, dental problems, strengthen the gums and stomach infection.

It is one of the three constituents of triphala used daily for easy bowels and promoting good health. The acetone extracts of *Terminalia bellirica* fruits were strong antibacterial against *E. coli, S. aureus, E. aerogenes, Ps. aeruginosa, S. paratyphi* and *S. typhimurium. Terminalia chebula* fruits were strong antibacterial against *E. coli, E. aerogenes, Ps. aeruginosa* and *S. typhimurium* ethanol extract. *Embilica officinalis* fruits in acetone extract were strong antibacterial against *E. coli, E. aerogenes, Ps. aeruginosa, S. typhimurium* and *S. typhi.* Ahmed *et al* [18] while studying their antimicrobial activities, observed similar results. All the organic solvent extracts of *Gardenia gummifera* resin were active against *E. aerogenes, K. pneumoniae* and *S. aureus.* Bioassay studies by Dabur *et al* [19] have reported antibacterial potential of leaves of *Acacia arabica* against diarrhea.

In the present study leaves of *Acacia arabica* from Melghat proved strong antibacterial against *E. coli, S. aureus, E. aerogenes, Sh. flexneri, S. paratyphi,* and *S. typhi. Acacia leucopholia* bark is used against stomachache by the korkus. The extracts of the plant's bark were strong antibacterial against *S. aureus* and moderate against *E. coli, Ps. aeruginosa, Pr. vulgaris, S. paratyphi, S. typhimurium* and *Sh. flexneri. Sphaeranthus indicus* fruits are prescribed by 'Bhumkas' against skin diseases and urine infections. In present investigation, strong antibacterial potential was observed against *S. aureus* and *Sh. flexneri.* Essential oils along with alkaloids in *Sphaeranthus indicus* are antibacterial components. Alkaloids have microbicidal effect against various intestinal pathogens [20]. *Sphaeranthus indicus* whole plant was strong antibacterial against *S. aureus, S. paratyphi, K. pneumoniae,* and *Sh. flexneri. Woodfordia fruticosa* flowers extracts proved strong antibacterial against *S. aureus* and *Ps. aeruginosa, which are major pathogens responsible for wound infections hence,* the study support the folklore use.

Dabur *et al* [19] observed antibacterial activity of Woodfordia fructicosa flowers in the range of 150 to 600µg/mL. The results were parallel to our findings for the highest contents in the discs i.e. 10 mg. Sensitivity of *S. aureus, Pseudomonas* supported flower's use as an antiseptic. Parekh and Chanda [21] had observed crude methanol extracts of *Woodfordia fruticosa* was good antibacterial at 5mg/mL than at 2.5mg/mL against all tested microorganisms as they were rich in Tannins. *Aegle marmelos* leaves showed strong antibacterial response against *E. coli* and *S. typhimurium, which* are responsible for mild diarrhea and gastroenteritis, indicating effective use by korkus. Balakrishnan *et al* [22] has reported hydro alcoholic extract of *Aegle marmelos* leaves was active against *S. typhi* similar to present work.

Flowers of *Butea monosperma* were reported as active internally against worms, piles, colic pains. Tannins in *Butea monosperma* were active internally in diarrhea, dysentery when new formulations in Western herbal medicines were designed and studied for their antibacterial phytochemicals [20]. Ethanol extract of *Butea monosperma* was able to produce sensitivity in *S. typhi, E. coli, Pseudomonas* and *S. paratyphi.* Korkus use dried fruits of *Helicteres isora* in

intestinal disorders, colic pain, flatulence, and diarrhea. Aqueous extract was strong antibacterial against *Ps. aeruginosa, S. paratyphi, Pr. vulgaris, K. pneumoniae* and *Sh. flexneri* due to presence of anthraquinone glycosides, steroids, proteins, tannins and phenolics. These findings confirmed folkloric use of *Helicteres isora* fruits as a medicine. The effective use in folkloric medicine was established by present study. *Maytenus emerginata* leaves ethanol extract was antibacterial to *Klebsiella* sp. and *Pr. vulgaris*. Parallel results were also observed by Nair *et a* [23]. *E. coli, S. aureus, E. aerogenes*, *S. typhi, S. typhimurium,* and *Sh. flexneri* were mild sensitive. *Pr. vulgaris* was strongly sensitive to ethanol extract of Maytenus root.

Pseudomonas was also strongly inhibited but *Sh. flexneri; S.paratyphi* and *E.coli* were resistant to ethanol extract at highest conc. of 10 mg of the root. While others were mild sensitive to the same, extract. Dwivedi *et al* [6] estimated the use of *Caesalpinia bonducella* against malaria in his work on evaluation of antimalarial herbal drugs. Seeds contain bitter substance phytosterinin, bonducin, saponin, fatty oil, and two glycosides. Gislene *et al* [24], studied synergistic action of plant extracts and antibiotics against various organisms including *Ps. aeruginosa*, which were resistant to many of the antibiotics. Synergistic action of *Syzgium cumuni* leaves extracts and antibiotics produced remarkable inhibitory effects. Strong antibacterial potential against *S. aureus, E. coli,* and *Ps. aeruginosa* in present work suggested that *Syzgium cumuni* leaves could cure skin infections stomachache diarrheal conditions produced by these organisms.

CONCLUSION: Scientific research of medicinal plants revealed some new antimicrobials from the plant extracts. Study conclude that the crude extracts of *Woodfordia fructicosa, Sphaeranthus indicus, Butea monosperma, Acacia leucopholia* and *Maytenus emerginata* exhibited significant antimicrobial activity and properties that support folkloric use in the treatment of enteric bacterial infections as broad spectrum antimicrobial agent. This probably explains the use of these plants by the indigenous people against a number of infections since generations.

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