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ANTIMICROBIAL HERBAL DRUGS

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ABSTRACT
An anti-microbial is a substance that kills or inhibits the growth of microorganisms such as bacteria, fungi, or protozoans. Antimicrobial drugs either kill microbes (microbiocidal) or prevent the growth of microbes (microbiostatic). Sulphonamide drugs were the first antimicrobial drugs, and paved the way for the antibiotic revolution in medicine. The first sulfonamide, trade named Prontosil, was actually a prodrug. However, with the development of antimicrobials, microorganisms have adapted and become resistant to previous antimicrobial agents. In view of certain side effects caused due to usage of modern antimicrobial drugs and antibiotics scientists have made some attempts to screen some of the Ayurvedic herbs, which possess broader spectrum of safety. Some selected herbs which are used by tribal and rural people for curing various infective diseases caused due to bacteria, virus and fungi have been reported to possess anti-microbial properties. In the present paper and attempt is made to review about the indigenous medicinal plant which exhibited antimicrobial properties.

Keywords: Antimicrobial,Krimighna, Aupasargika roga.

INTRODUCTION

In the long pre-ehrlich era (before 1891 AD) many compounds were employed in therapeutics empirically and the treatment of Malaria with cinchona and use of mercury in syphilis were a few treatment regimens available during that period. After 1935 AD, a great variety of infective organisms were identified and various chemo-therapeutic drugs were also developed. In the modern Pharmacology Paul Ehrilich (1874-1915 AD), who was called "The father of modern Chemo-therapy" has demonstrated the efficacy of Methylene blue in the treatment of Malaria and introduced Arsephenamine, the first really effective chemo-therapeutic agent in the treatment of syphilis. Later on Chemo-therapeutic drugs like Sulfonamides and antibiotics like Penicillin, Streptomycin etc., were invented. Sushruta was the first medical scientist who has identified diseases namely Kustha (Leprosy including other skin diseases), Jwara (Fever due to Bacteria, virus and parasites) Shosha (T.B. and other immunodeficiency disorder) and Netra-abhisyanda (conjunctivitis) as Aupasargika roga (communicable diseases) and described the management with certain Herbs belonging to various groups namely Arkadi (Arka , Karnja, Rasna etc.), Surasadi (Tulasi, Vidanga, Nirgundi etc.) and Lakshadi (Laksha, Kutaja, Nimba, Haridra, Daruharidra, Saptaparni etc.)[1].

Charaka in treatise described the following herbs under Krimighna dashemani,[2]

1. Akshiva – *Moringa oleifera* Lam.
2. Maricha – *Piper nigrum* Linn.
3. Gandira – *Euphorbia antiquorum* Linn.
4. Kebuka – *Costus speciosus* (Koen) Sm.
5. Vidang – *Embelia ribes* Burm. F.
6. Nirgundi – *Vitex nigundo* Linn.
7. Kinhi – *Achyranthes aspera* Linn.
8. Svadanshtra – *Tribulus terrestris* Linn.
9. Vrusha-parnika – *Ipomoea biloba* Forsk.
10. Akhuparnika – *Ipomoea reniformis* Chois

In view of certain side effects caused due to usage of modern antimicrobial drugs and antibiotics scientists have made some attempts to screen some of the Ayurvedic herbs, which possess broader spectrum of safety. In most of the microbial studies the Indian medicinal plants have exhibited anti-fungal, anti-bacterial and anti-viral properties .

Researches carried out on some of the anti-microbial herbs are reviewed here under[3]:

SN	Latin name	Sanskrit name	Activity reported
1	*Achyranthes aspera* Linn.	Apamarga	Leprosy, particularly sub-acute and mild type
2	*Acorus calamus* Linn.	Vacha	*M. tuberculosis*
3	*Alpinia galanga* Willd.	kulanjana	*M. tuberculosis* and gram negative organisms
4	*Araca catechu* Linn.	Pooga	*Staphylococcus* and *Escherichia coli*
5	*Azadirachta indica* A. Juss	Nimba	*M. tuberculosis, S. typhosa, S. paratyphi, Vibrio cholerae, Klebsiella pneumoniae* and *paramaecium caudatum*
6	*Berberis aristata* DC.	Daruharidra	*Vibrio cholerae* (berberine)
7	*Bryophyllum calycinum* salisb.	Parnabija	Anti-bacterial activity, wide range of gram positive and gram negative bacteria (bryophyllin)
8	*Cassia fistula* Linn.	Aragvadha	*S. aureus, S. albus, B. megatherium, S. flexneri, S.shigae, S. typhi para A* and *para B*
9	*Cassia occidentalis* Linn.	Kasamarda	*S. aureus, B. subtilis* and *V. cholera*
10	*Cucurbita maxima* Duch. ex Lam	Peeta kushmand	*M. tuberculosis*
11	*Curcuma longa* Linn.	Haridra	Gram-positive and gram-negative organisms
12	*Cyperus rotundus* Linn.	Mustaka	*Staphylococcus aureus*
13	*Desmodium gangeticum* DC	Shalaparni	*S. aureus* and *B. subtilis*
14	*Emblica officinalis* Gaertn.	Amalaki	*M. pyogenes* var. *aureus, S. typhosa, S. paratyphi, albus, S. schottmulleri* and *S. dysenteriae*
15	*Hedychium spicatum* Buch-Ham	Shati	*Cl. Welchii, V. cholerae Ogawa, Strep. Faecalis, C. diphtheriae, Sh. Shigae, S. typhi, E. coli, Ps. Aeruginosa, Staph pyogenes* and *Staph aureus*
16	*Helianthus annuus* Linn.	Adityabhakta	*Staph. Aureus*
17	*Hemidesmus indicus* (Linn) R. Br.	Sariva	*Staph. Aureus, Staph. Albus, Sal. Typhosa, V. cholerae, Esch. Coli, Sh. Singae, Sh. Flexineri* and *Sh. Sonnei*
18	*Inula racemosa* Hook. f.	Pushkaramoola	*E. coli, Kl. Pneumoniae, Staph. Albus, Staph. Aureus, Ps. Aeruginosa, P. vulgaris, B. subtilis* and *C. pyogenes*
19	*Jasminum officinale* Linn Forma grandiflorum (linn.) Kobuski.	Jati	*Staph. Aureus*

20	*Lawsonia inermis* Linn.	Madayantika	*M. pyogenes* var. *aureus, Strep. pyogenes, Dip. pneumoniae, B. subtilis, E. coli, Sal. typhosa, Vib. comma* and *Sh. dysenteriae*
21	*Leptadenia reticulata* wight & Arn.	Jeevanti	*M. pyogenes* var. *aureus, M. pyogenes* var. *albus, M. pyogenes* var. *citreus, B. megatherum, Strep. Pyogenes var. haemolyticus, S. typhosa, S. paratyphi, E. coli, S. schottmulleri, P. vulgaris* and *Ps. Pyocyanea*
22	*Leucas aspera* (Willd.) Spreng.	Dronapushpi	*E. coli, S. typhosa, Vib. Comma* and *Sh. Dysenteriae*
23	*Madhuca longifolia* (koen) Macb.	Madhuka	*B. anthracis, B. pumilus, B. subtilis, S. paratyphi, V. cholera, Xanth. Campestris* and *Xanth. Malvacearum*
24	*Mallotus philippinensis* Muell. Arg.	Kampillaka	*B. subtilis, Staph. Aureus*
25	*Melia azadirachta* Linn.	Mahanimba	*Staph. aureus, B. subtilis, E. coli* and *Xanth. Citri*
26	*Mentha spicata* Linn. Emend Nathh	Pootiha	*Staph. Aureus* and *E. coli*
27	*Mesua ferrea* Linn.	Nagkeshar	*Staph. Aureus, E. coli, V. cholera, Eberthella typhosa, B. friedl*anderi and *M. phlei* *B. subtilis, Sh. Dysenteriae, Strep. Pyogenes, S. typhosa, Sar. Lutea, Strep. Faecalis, B. pumilus* and *Ps. Solanacearum (oil)*
28	*Mimusops elengi* Linn.	Bakula	*B. anthracis, B. mycoides, B. pumilus, B. subtilis, S. paratyphi, Staph. albus, V. cholerae, Xanth. campestris, Xanth. malvacearum*
29	*Momordica charantia* Linn.	Karvellaka	*Sh. negatar, E. coli* and *Ps. aeruginosa*
30	*Moringa oleifera* Lam.	Shigru	*Staph. aureus, M. pyogenes var. aureus, B. subtilis, Dip. pneumoniae, Strep. pyogenes, E. coli, V. cholerae, Sh. Dysenteriae* and *S. typhosa*
31	*Murraya koenigii* (Linn.) Spreng	Kaidarya	*B. subtilis, Staph. aureus, C. pyogenes, P. vulgaris* and *pasteurella multicida*
32	*Myristica fragrans* houtt.	Jatiphala	*Staphylococcus, B. anthracis, B. pumilus, B. subtilis, B. mycoides, E. coli, Ps. magniferae indicae, Sar. lutea, S. typhosa, S. paratyphi, S. aureus, S. albus, V. cholerae, Shigella sp. 1 &2, Xanth. campestris*
33	*Nardostachys jatamansi* DC	Jatamansi	*Staph. aureus, E. coli, Strep. pyogenes, Sal. pullorum, Pasteurella multocida* and *Ps. aeruginosa*
34	*Nigella sativa* Linn.	Kalajaji	*Staph. aureus, E. coli, M. pyogenes var. aureus, B. subtilis, Strep. pyogenes* *B. anthracis, B. pumilus, B. subtilis, Sh. dysenteriae, S. paratyphi, S. typhi, E. coli, Sh. boydii, Sh. nigar, Sh. sonnie B. eereus, Staph. lutea, Ps. aeruginosa*
35	*Ocimum americanum* Linn.	Sweta tulasi	*Staph. aureus, E. coli, Strep. pyogenes, S. typhosa, Mycobacterium H37 RV*
36	*Ocimum basilicum* Linn.	Barbari	*B. typhosa, B. pumilus, Sh. negarata, Sar. lutea, P. vulgaris,* and *Kl.pneumoniae, B. subtilis, B. anthracs, S. paratyphi, Xanth. campestris*
37	*Ocimum sanctum* Linn.	Tulasi	*Staph. aureus, E. coli, M. tuberculosis, M. pyogenes var. aureus*
38	*Phyllanthus urinaria* Linn.	Bhumyamalaki	*E. coli, V. cholerae, E. coli, Sh. dysenteriae*
39	*Picrorhiza kurroa* Royle ex. Benth	Katuki	*Staph. aureus, E. coli, S. typhi*
40	*Piper betle* Linn.	Tambula	*M. pyogenes var. aureus, Dip. pneumoniae, Strep. pyogenes, Vibrio cholerae, B. subtilis, Sh. dysenteriae, E. coli, S. typhosa, B. megatherum, Staph. aureus, Staph. albus, Sar. lutea, P. vulgaris, erwinia carotovora* and *Ps. solanacearum*
41	*Piper cubeba* Linn. f.	Kankola	*B. subtilis, V. cholerae, C. diphtheriae, S. typhi, Strep. pyogenes, B. punilus, Ps. solanacearum, Strep. paecalis*
42	*Piper longum* Linn.	Pippali	*B. subtilis, B.cereus, M. tuberculosis, S. aureus, S. albus, Sar. lutea, B. shigella dysenteriae, E. coli, E. boydii, S. typhi, V. cholerae,* *Sh. Negarata, S. paratyphi (Oil)*
43	*Piper nigrum* Linn.	Marich	*E. coli, Aerobacter aerogenes, L. casei, Staph. faecalis, Staph. aureus, Sh. sonnei, S. albus, C. diphtheriae, Sh. dysenteriae, Sar. lutea, B. pumilus, Ps. pyogenes, Strep. pyogenes, Micrococcus sps and Ps. solanacearum, B. subtilis, Staph. aureus, S. typhosa, S. paratyphi* and *pestalotia sp.*
44	*Plumbago zeylanica* Linn.	Chitraka	*B. pumilus B. subtilis, B. mycoides, S. typhi, S. paratyphi, Sar. lutea, Staph. aureus, Xanth. Citri, Xanth. malvacearum,* *S. aureus, S. albus, S. paratyphi, Staph. Citreus, Sal. dubin* and *Klebsiella pneumonia*
45	*Pongamia pinnata* (Linn.) Pierre	Karanja	*B. anthracis, Ps. mangiferae, S. typhi, B. pumilus, B. mycoides, E. coli, Sar. lutea, Staph. aureus, staph. albus, Xanth. campestris,* *M. pyogenes var. aureus, M. pyogenes var. citreus, B. subtilis, C. diphtheria, S. typhosa, S. typhi para A* and *para B, E. coli* and *M. tuberculosis*
46	*Prunus amygdalus* Batch.	Vatada	*Staph. pyogenes, E. coli, B.proteus, Ps. pyocyaneus, Kl. aerogenes, Strep. pneumonia, strep. haemolyticus, Strep. viridians, Alkagenius faecales* and *Staph. albus*
47	*Psoralia corylifolia* Linn.	Bakuchi	*E. coli, Kl. aerogenes, staph. albus, S. aureus, B. subtilis, B. anthracis, Sal. pulloran, Sal. typhimurium, P. vulgaris* and *Klebsiella sps.*
48	*Punica granatum* Linn.	Dadima	*S. typhosa, S. paratyphi, Klebsiella pneumonia, Sh. Flexneri, B. anthracis, B. pumilus B. subtilis, S. paratyphi, V. cholerae, Xanth. campestris* and *Xanth. malvacearum*

A critical review of Ayurvedic therapeutics clearly indicates that several infective conditions have been dealt in detail with herbal and herbo-mineral formulations. For many centuries, the tribal community had a traditionally self-managed system of folk medicine. This system has certain relevance to the great tradition of Ayurveda. Some selected herbs which are used by tribal and rural people for curing various infective diseases caused due to bacteria, virus and fungi have been reported to possess anti-microbial properties[4].

1. Investigations were carried out to evaluate the therapeutic properties of the seeds and leaves of *Moringa oleifera* Lam as herbal medicines. Ethanol extracts showed anti-fungal activities in vitro against dermatophytes such as *Trichophyton rubrum, Trichophyton mentagrophytes, Epidermophyton Xoccosum,* and *Microsporum canis*[5].
2. Seed powder *of Caesalpinia crista*[6], stem bark and seeds of *Holarrhena anti-dysentrica*[7] and root powder of *Asparagus racemosa* have shown significant amoebicidal property.
3. The herbs namely *Alstonia scholaris*, *Caesalpinia crista*, *Picrorrhiza kurroa* and *Swertia chirata* in combination found to be very effective in treating malaria including *P.falciparum* infection[8].
4. *Acorus calamus*, *Alpinia galanga* and *Cucurbita maxima* have shown anti-tubercular property[9],
5. *Berberis aristata* found to be very useful in the management of cholera[10],
6. *Ocimum sanctum* and *Curcuma longa* are found to have anti-viral and anti-bacterial property.
7. The drug namely *Phyllanthus niruri* and *Picrorrhiza kurroa* have shown anti-viral action against hepatitis 'B' virus.

8. The herbs *Centella asiatica* and *Hydnocarpus* have profound anti-leprotic action[11].
9. The methanol leaf extracts of *Acacia nilotica*, *Sida cordifolia*, *Tinospora cordifolia*, *Withania somnifera* and *Ziziphus mauritiana* showed significant antibacterial activity against *Bacillus subtilis, Escherichia coli, Pseudomonas fluorescens, Staphylococcus aureus* and *Xanthomonas axonopodis pv. malvacearum* and antifungal activity against *Aspergillus flavus, Dreschlera turcica* and *Fusarium verticillioides* when compare to root/ bark extracts. *A. nilotica* and *S. cordifolia* leaf extract showed highest antibacterial activity against *B. subtilis* and *Z. mauritiana*, leaf extract showed significant activity against X. a. pv. Malvacearum and root and leaf extract of *S. cordifolia* recorded significant activity against all the test bacteria. *A. nilotica* bark and leaf extract showed significant antifungal activity against *A. flavus*. *Ziziphus mauritiana* and *Tinospora cordifolia* recorded significant antifungal activity against D. turcica. The methanol extract of *Sida cordifolia* exhibited significant antifungal activity against *F. verticillioides*[12]
10. Many essential oils are included in pharmacopoeias which are having antimicrobial activity, including: Oregano oil, Tea tree oil - in cosmetics, medicine, Mint oil - in medicine, cosmetics (tooth paste etc.) Sandalwood oil - in cosmetics, Clove oil - stomatology etc. *Nigella sativa* (Black cumin) oil, Onion oil (*Allium cepa*) - phytoncides, in phytotherapy, Leleshwa oil Lavender oil, Lemon oil, myrtle oil, Neem oil Garlic, Eucalyptus oil, Peppermint oil, Cinnamon oil and Thyme oil[13]
11. Significant antimicrobial action was observed in the leaves, stem bark and fruit pulp of Cassia fistula and anti-fungal activity in the bark of the stem and root. Crude methanol extracts from leaves of Cassia alata, Cassia fistula and Cassia tora were investigated for their antifungal activities on three pathogenic fungi (*Microsporum gypseum, Trichophyton rubrum* and *Penicillium marneffei*). Among 3 species, *C. alata* (Brihat Chakramarda) was the most effective leaf extract against *T. rubrum* and *M. gypseum* with the 50% inhibition concentration (IC50) of hyphal growth at 0.5 and 0.8 mg/ml, respectively, whereas the extract of *C. fistula* was the most potent inhibitor of *P. marneffei* with the IC50 of 0.9 mg/ml. In addition, it was found that all three Cassia leaf extracts also affected *M. gypseum* conidial germination. Microscopic observation revealed that the treated hyphae and macroconidia with leaf extracts were shrunken and collapsed, which might be due to cell fluid leakage[14].
12. "Antifungal activities of the alcoholic extract of coconut shell—*Cocas nucifera* is also reported.

CONCLUSION

The review so far made clearly indicate that the herbs are the rich source of potent anti-infective drug molecules and they produce a host of bio-active molecules, most of which probably evolved as chemical defenses against infections. The indigenous herbs namely Nimba (*Azadirachta indica*), Haridra (*Curcuma longa*), Daruharidra (*Berberis aristata*), Tulsi (*Ocimum sanctum*) and Karanja (*Pongamia pinnata*) have been included in various classical formulations meant for the management of different bacterial, viral and parasitic infections. The herbs namely *Alostonia scholaris*, *Caesalpinia crista*, *Picrorrhiza kurroa* and *Swertia chirata* in combination found to be very effective in treating malaria including *P.falciparum* infection. For many centuries, the tribal community had a traditionally self-managed system of folk medicine. This system has certain relevance to the great tradition of Ayurveda. *Cissampelos pareira* (Patha), *Andrographis paniculata* (Kiratathika), *Nyctanthes arbortristis* (Parijata), *Soymida febrifuga* (mamsarohini), *Terminalia tomentosa* (Asana), *Tinospora cordifolia* (guduchi), *Mimosa pudica* (Lajjalu), *Aerva lanata* (Gorakshagajja), *Malaxis rheedii*, *Aganosma caryophyllata* are being used by tribals in the management of fevers due virus, bacteria and parasites.

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