Medicinal Plants and its Pharmacological Activities: A Review

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Abstract : Medicinal plants have bioactive compounds which are used for curing various human diseases and also play an important role in healing. Phytochemicals have two categories i.e., primary and secondary constituents. Primary constituents have chlorophyll, proteins sugar and amino acids. Secondary constituents contain terpenoids and alkaloids. Successive isolation of phytocompounds from plant materials depended on the type of solvent used in extraction procedure. A scientific evaluation of herbs or medicinal plants according to their ethnopharmacological or traditional methods of use in various diseases management can incorporate them into the complementary and alternative medicine. In the present study attempts were made to review on some medicinal plants and its pharmacological activities.

Index Terms* : *Antimicrobial, Antibacterial, Anti inflammatory and Antioxidant activity

I. INTRODUCTION

For centuries, humans believed in the healing properties of medicinal plants. Indigenous knowledge on the use of these medicinal plants has been passed down from generation to generation, providing great expertise on their ethnobotanical use. It is in the 20th century that the field of medicinal plants attracted great interest in scientific researchers, leading to a surge of natural plant research. Today, up to 50% of the world drugs are made from natural products or their derivatives [1].

More number of different biologically active and therapeutic potential phytochemicals are drawn from plant kingdom. The utilization of those natural substances for human aliments as well as animals begins from time immortal. Till date almost 3000 different medicinal plants in Indian subcontinent has found great potential in the emerging field of herbal medicines. More specific information about plant source as medicine had been mentioned in our old golden heritagious ayurvedic literatures and also other alternate system of medicine. Numerous number of phyto compounds were characterized from plants which are now using in modern herbal pharmacy for the treatment of many diseases. Well authenticated medical plants may play an important role in the management of different clinical problems especially in developing countries [2].

Medicinal plants have provided copious leads to combat diseases, from the dawn of civilization. India is one of the world's 12 biodiversity centers with the presence of over 45000 different plant species .Traditional systems of medicine continue to be widely practiced on many accounts. Many of these plants are rare and endemic and found only in forest region. There is neither biological information nor adequate knowledge that led to their rarity in the habitat .Creation of a network of regional and sub-regional ethno-medicinal plant gardens which should contain accessions of all the medicinal plants known to the various ethnic communities in different regions of India [3].

II. ANTIMICROBIAL ACTIVITY:

Ramproshad et al [4] carried out the antimicrobial activity of the ethanolic extract of *Plumeria rubra* by disc diffusion method which showed activity against *Salmonella typhi.* Moreover, the extract of leaves produced significant writhing inhibition in acetic acid induced writhing in mice at the oral dose of 500 mg/kg body weight [$P<0.05$] which was comparable to the standard drug Diclofenac sodium at the dose of 25 mg/kg of body weight.

Vedhanaratanan and Unnikannan [5] studied the antimicrobial activity of different extracts [chloroform, ethanol and methanol] of *Wrightia tinctoria* against the human pathogenic bacterial strains *Escherichia coli, Bacillus subtilis, Staphylococcus aureus* and *Pseudomonas aeruginosa* by disc diffusion method on agar. The findings showed potential antimicrobial properties of the extracts against the organisms tested. Among the three solvents tested ethanol extract of leaf showed higher inhibition zone. Ethanol extract of *Wrightia tinctoria* exhibits maximum zone of inhibition against *Escherichia coli* [29 mm], *Bacillus subtilis* [24 mm], *Staphylococcus aureus* [30 mm] and *Pseudomonas aeruginosa* [24 mm].

Deepan and Alekhya [6] studied invitro antimicrobial activity of leaves of *cardiospermum halicacabum linn* [Sapindaceae]. The extracts exhibited marked antimicrobial activity against Gram positive and Gram negative bacteria. When the concentration of the extracts was increased the zone of inhibition also increased. The average zone of inhibition [18 mm] of aqueous extract [50 mg/ ml] was smaller [26 mm] than that of the standard drug [50mg/ml]. But it was too low in alcoholic extract [14mm]. According to the results aqueous extract was effective than the alcoholic extract.

Kumarasamyraja et al [7] carried out the antimicrobial activity of chloroform extract of *Acalypha indica* against two gram positive and two gram negative human pathogenic bacteria and fungi viz *Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli* and fungus cultures *Candida albicans and Aspergillus niger* by using Ml diffusion method. The study indicated that the chloroform extract of *Acalypha indica* plant was effective against *Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli* and showed a promising antibacterial activity at 300g/ml

concentration. Similarly the extract at the same level of concentration also exhibited significant antifungal activity against *Candida albicans* and *Aspergillus niger*.

Dhole et al [8] tested the aqueous and ethanolic extracts of selected weeds such as *Portulaca oleracea* L. [Portulaceae], *Cardiospermum helicacabum* L. [Sapindaceae], *Euphorbia hirta* L. [Euphorbiaceae], *Crotalaria retusa* L. [Fabaceae] and *Euphorbia heterophylla* L. [Euphorbiaceae] for phytochemical analysis and antimicrobial activity. The antimicrobial activities were tested against two gram-positive bacteria [*Bacillus subtilis, Staphylococus aureus*], one gram-negative bacterium [*Pseudomonas aeruginosa]* and a mould *Aspergillus niger* by agar diffusion method. Remarkable antibacterial activity was observed in the aquous and ethanolic [root and leaves] extracts of *Portulaca oleracea* L. while *Cardiospermum helicacabum L.* showed no results in same experimental conditions as compared with standard antibiotics. While in case of ethanolic extract of *Portulaca oleracea* L. showed maximum antimicrobial activity against *Pseudomonas aeruginosa* showing zone of inhibition [46 mm].

Elamathi and Kavitha [9] evaluated the antibacterial activities of leaf of *Ecbolium viride* in successive different solvent against gram positive [*Staphylococcus aureus, Streptococcus pyogenes* and *Leuconostoc lactis*] and gram negative [*Escherichia coli, Pseudomonas aeruginosa* and *Salmonella typhi*] organisms as well as the fungus [*Aspergillus niger, Aspergillus flavus, Rhizopus indicus* and *Mucor indicus*]. For antimicrobial test, well diffusion technique was used and the zone of inhibition of microorganisms was measured in mm. The effect of aqueous extracts was less on the tested bacteria compare to methanolic extracts where more antibacterial effect was observed with a maximum inhibitory zone of 28mm against *Leuconostoc lactis*. The antibacterial effect of aqueous extracts was comparatively zero.

Hussain et al [10] carried out the phytochemical and antimicrobial bioassay of five medicinal plants *Lepidium sativum, Nerium oleander, Ranunculus repens, Tecoma stans* and *Urtica dioca*. Phytochemical inveigation of plant samples determines that alkaloid [63.6%] and flavonoid [0.91%] were highest in *N. oleander,* saponin [11%] and phenol [0.031] in *T. stans,* tannin [0.61%] in *L. sativum*. All five species showed no significant antimicrobial activities.

Senthil Kumar and Sivamani [11] tested the leaves extract of *Calotropis gigantean* for its antimicrobial and phytochemical activities. The solvents used for the leaves extraction were ethanol, methanol, chloroform and n-hexane. The extract was tested against infectious diseases causing fungal pathogens such as *Aspergillus flavus, Aspergillus niger, Aspergillus fumigates, Candida tropicalis, Candida albicans* and bacterial pathogens such as *Bacillus cereus, Salmonella typhi, Proteus mirablis, Escherichia coli* and *Pseudomonas aeruginosa* using the Agar well diffusion method. The ethanol extract of *Calotropis gigantea* showed more activity against fungus like *Candida albicans* zone of diameter 15.06±0.11, *Candida tropicalis* zone of diameter 13.30±0.26 and bacteria like *Proteus mirablis* zone of diameter 12.16±0.15 and *Pseudomonas aeruginosa* zone of diameter 8.0±0.00 when compared to other solvent extracts.

Bhaskara Rao et al [12] evaluated the antimicrobial activity of the aqueous extract of leaves of *Elaeocarpus ganitrus* against clinical isolates of bacteria and fungi. *Invitro* antimicrobial activity was performed by agar well diffusion method on Mueller Hinton agar and Sabouraud Dextrose agar for bacterial and fungal cultures respectively. The extract exhibited a broad spectrum of antimicrobial activity as it inhibited the growth of *Staphylococcus aureus, Bacillus cereus, Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae, Penicillium* sp, *Aspergillus flavus, Candida albicans* and *C. tropicalis*. The extract showed maximum relative percentage inhibition against *B. cereus* [124.16%]. Minimum inhibitory concentration test was performed by modified agar well diffusion method. Minimum inhibitory concentration values of the extract varied from 125-2000 µg/ml; however minimum value was reported against *B. cereus* and *A. flavus* [125 µg/ml]. The results indicated the potential use of *E. ganitrus* leaves for the development of antimicrobial compounds.

Thenmozhi and Rajeshwari Sivaraj [13] tested the premillinary phytochemical analysis and antimicrobial activity of different extarcts [petroleum ether, chloroform, ethyl acetate, ethanol and aqueous] of leaves of *Polyalthia longifolia* against six different bacteria by disc diffusion method. The various metabolites present in all the extracts. Among various solvent extracts studied, chloroform extract showed higher degree of inhibition followed by ethylacetate, ethanol, petroleum ether and aqueous. The various extracts were tested against the *Escherichia coli, Bacillus subtilis, Staphylococcus aureus and Salmonella typhi* for antimicrobial activity.

Zahir Hussain and Kumaresan [14] tested the different concentration methanol extract of *Abrus precatorius. L p*lant shows antimicrobial activity against the organisms in the order of *Staphylococcus aureus[14 mm], Vibrio cholera[16 mm], Yersinia enterocolitica[13 mm], Salmonella typhi[16 mm], Bacillus subtilis[17 mm], Listeria monocytogenes[15 mm], Klebsiella pneumonia[18 mm], Bacillus megaterium[15 mm]*. In case of fungi activity against tested organisms was in the order of *Aspergillus niger [16 mm], Candida albicans[14 mm]*. In case of the maximam antibacterial activity was observed against *Klebsiella pneumonia.* The plant extracts were subjected to test the antimicrobial activity by disc diffusion method.

Sujatha and Gowri Prakash [15] tested the aqueous, ethanol and benzene extracts of flower from three medicinal plants of *Tribulus terrestris, Pavetta indica* and *Saraca asoca* for possible sources of antimicrobial activities and phytochemical constituents. Occurrence of the phytochemicals in all the three different plant flowers mainly depends upon the solvent efficiency. The preliminary evaluations of both the aqueous and solvent benzene ethanol extracts exhibited appreciable inhibitory activities on the tested pathogenic bacterial isolates at concentration of 30mg/L. Results of inhibition zone in *S. asoca* showed more therapeutic activity where the benzene flower extract demonstrated significant [P<0.05%] inhibitory activity 49±4.1mm in diameter on the tested *K. pneumonea* bacterial isolates. Similarly ethanol extract of *P. indica* flower showed of highest range of inhibition zone between [30±5.3 to 40±7.1 mm] observed on *S. aureus* and *S. typhi* respectively.

Abebe et al [16] analyzed the chemical composition of essential oils from the leaves of *Justicia schimperiana.* Totally twenty eight different compounds were identified; making up 75.18 percentage, the essential oils of *Justicia schimperiana* has not showed obvious activity against *Escherichia coli, Bacillus subtilis* and *Candida albicans.*

Fayera et al [17] carried out the phytochemical investigation and antimicrobial activities of the leaves extract of *Plantago lanceolata* with organic solvents petroleum ether, chloroform/methanol [1:1] and methanol respectively. It revealed the presence of steroids, alkaloids, flavonoids, saponins, glycosides, phenols, tannins and terpenoids. The petroleum ether extract was purified over silica gel preparative thin layer chromatography and yielded an isolated compound PL-5. The structure of this compound was elucidated using different spectroscopic techniques such as FT-IR, 1H-NMR, 13C-NMR and DEPT-135 spectral data and by comparing the data with literature reports. The crude extracts, isolated pure compound and n-hexane extracted oil were tested against four bacterial species [Gram negative bacteria: *Escherichia coli* and *Salmonela thyphei*, Gram positive bacteria: *Staphylococcus aureus, Streptococcus agalactiae*] and two fungal species [*Aspergillus niger* and *Fusarium solani*] using paper disc diffusion method. All crude extracts, isolated pure compounds and extracted oil were active against all the tested bacterial. Additionally petroleum ether and chloroform/methanol [1:1] crude extracts and n-hexane extracted oil were active against the two fungal species and hence the present work supported the medicinal use of *Plantago lanceolata*.

III. ANTIBACTERIAL ACTIVITY

S.Al- Daihan et al [18] investigated aqueous and methanol extracts of *Zingiber officinale, Curcuma longa, Commiphora molmol* and *Pimpinella anisum* for antimicrobial activity. The microorganisms employed were *Streptococcus pyogenes, Staphylococcus aureus, Escherichia coli* and *Pseudomonas aeruginosa*. The susceptibility of bacteria strains against the two extracts was determined using the disc diffusion method. The most susceptible microorganisms were *S. pyogenes, S. aureus*, while the least susceptible was *E. coli*. Highest antibacterial activity was observed with methanol extract of *C. longa* and *C. molmol* against *S. pyogenes* and *S. aureus* [19 mm] respectively while minimum activity was observed with aqueous extract of *P. anisum* against *E. coli* and *P. aeruginosa* [7 mm]. Methanolic extracts of almost all samples dominated aqueous extracts in inhibiting the growth of the pathogenic bacteria under study but were less potent when compared to those of kanamycin used as positive controls.

Jayalakshmi and Raveesha [19] evaluated the antibacterial activity of various solvent extracts of medicinal plants against the human pathogenic bacteria *Escherichia coli, Klebsiella pneumonia, Bacillus subtilis, Bacillus cereus, Salmonella typhi, Enterobacter aerogenes* and *Staphylococcus aureus* by agar cup diffusion method. Methanol extracts of *Clerodendrum inerme* L., *Terminalia chebula* Retz., *Curcuma amada* Roxb., *Anacardium occidentale* L., *Duranta repens* L., *Eucalyptus camaldulenis and Euphorbia cotinifolia* L. showed significant activity. The petroleum ether and chloroform extracts of *Terminalia chebula, Curcuma amada and Piper betel* also showed promising results. The antibacterial activity of promising plant extracts when compared with standard drugs streptomycin and gentamycin recorded siginificant inhibition.

Jigna Parekh and Darshana Jadeja [20] screened twelve medicinal plants namely *Abrus precatorius L., Caesalpinia pulcherrima Swartz., Cardiospermum halicacabum L., Casuarina equisetifolia L., Cynodon dactylon [L.] Pers., Delonix regia L., Euphorbia hirta L., Euphorbia tirucalli L., Ficus benghalensis L., Gmelina asiatica L., Santalum album L.,* and *Tecomella undulata [Sm.]* Seem for potential antibacterial activity against five medically important bacterial strains namely *Bacillus subtilis, Staphylococcus epidermidis, Pseudomonas pseudoalcaligenes, Proteus vulgaris* and *Salmonella typhimurium*. The antibacterial activity of aqueous and methanol extracts was determined by agar disc diffusion and agar well diffusion method. The methanol extracts were more active than the aqueous extracts for all twelve plants studied. The plant extracts were more active against Gram positive bacteria than against Gram negative bacteria. The most susceptible bacteria were *B. subtilis* followed by *S. epidermidis* while the most resistant bacteria were *P. vulgaris* followed by *S. typhimurium*. From the screening experiment *Caesalpinia pulcherrima Swartz*. showed the best antibacterial activity.

Sunil Christudas and Kulathivel [21] investigated the phytochemical screening and antibacterial activity of petroleum ether, chloroform and ethanolic extracts of *Tridax procumbens*. Comparatively chloroform extract was showing better [mild to moderate] activity against all the selected organisms. The activity of chloroform extract against *B. faecalis* and *E. coli* at the concentration 800 mg/mL was comparable with that of standard drug ampicillin. The ethanolic extract showed moderate activity against *B. faecalis* and the extract was devoid of activity against all other selected organisms. The petroleum ether extract also showed activity against *B. faecalis* similar.

Uma et al [22] stated the antibacterial activity of different extracts of *Scoparia dulcis* against pathogens . In the different extracts of *Scoparia dulcis* at 25 µl concentration, ethanolic extract showed maximum activity against *E.coli*. In 50 µl concentration of different extracts of *Scoparia dulcis*, the toluene extract showed maximum activity against *Klebsiella pneumoniae*. 75 µl of aqueous extract of *Scoparia dulcis* showed maximum activity against *Klebsellia pneumoniae*. *Klebsellia pneumoniae* showed maximum activity at 100 µl of ethanolic extract of *Scoparia dulcis.* 125 µl of methanolic extract of showed maximum activity against *Corneybacterium.*

Ganji et al [23] investigated the presence of antibacterial activity on the different root extracts of *Mimosa rubicaulis Lam.*. The extracts obtained using continuous hot percolation method and antibacterial activity tested by using cup plate method. The present investigation reveals that all the three extracts namely ethylacetate, methanol and water extracts of concentration 1000 mg/ml showing antibacterial activity against both gram positive and gram negative organisms. Among all the three extracts root methanolic extract showing more antibacterial activity. The study shown that the all the three root extracts of *Mimosa rubicaulis Lam.* possess antibacterial activity.

Zulfiker et al [24] stated in vitro antibacterial and antifungal activities of ethanolic extracts of S*coparia dulcis* L. [EESD] whole herb were evaluated in the present study by disc diffusion method using twelve human pathogenic bacterial strains and three fungal strains respectively. The activity was measured by determining zone of inhibition and minimum inhibitory concentration. The zone of inhibition values were compared with the standard kanamycin [30 µg/disc] and nystatin [20 µg/disc] for antibacterial and antifungal activity respectively and the minimum inhibitory concentration values were compared with

control. The zone of inhibition observed was between 6 to13 mm. It is concluded that EESD exhibited moderate antibacterial, antifungal and significant cytotoxic activity and thus would be a safer antibiotic and also an anticancer agent.

IV. ANTI INFLAMMATORY ACTIVITY:

Abhilasha Shourie and Kundal Kalra [25] stated *Abrus precatorius* is known to possess antiseptic and anti-inflammatory activity, which makes it useful in treatment of wounds. In this study different concentrations of ethanolic extracts of *A. precatorius* stem were investigated for evaluation of wound healing activity in rats. Wistar albino rats have been grouped into three sets- first set was uninfected with wounds, second set was infected with *Staphylococcus Aureus* and third set was infected with *Candida albicans*. Different concentrations of ethanolic extracts of *A.precatorius* [60, 90, 120mg/ml] were applied topically in the form of ointment to wounds inflicted on rats and healing was assessed by the rate of wound contraction and epithelialization period. All extracts were found to be active against the pathogens, while the ethanolic extract exhibited highest inhibition and document the beneficial effects for acceleration of wound healing activity in rats.

Essien and Nwidu [26] investigated the preliminary phytochemical screening, anti-inflammatory and analgesic potentials of the methanolic extracts of *Emilia sonchifolia* [ES] in mice using carragenin, egg albumin, capsaicin-induced paw oedema, formalin-induced paw licking, acetic acid induced writhing and hot plate nociception in mice. The LD50 i.p. was calculated to be 2874.02mg/kg. The extract [287.4, 574.8, 862.2, ASA [100mg/kg] and 574.8 + ASA [mg/kg] [i.p.] produced a dose dependent [$p<0.05$-0.001] inhibition carragenin, egg-albumin, capsaicin, formalin-induced paw licking, acetic acid-induced writhing and hot plate nociception in mice.

Vijayabaskaran et al [27] carried out the investigation to find the effect of ethanol extract of *Pseudarthria viscida* [EEPV] for its anti-inflammatory activity in rat. In this study, the anti-inflammatory activity of *Pseudarthria viscida* was evaluated by using a carrageenan-induced rat paw edema model and compared with that of standard drug Indomethacin. Oral administration of the extract at the doses 200 and 400 mg/kg b.w. exhibited dose dependent and significant anti-inflammatory activity in carrageenan-induced hind paw edema of inflammation. Both the dose of *Pseudarthria viscida* promoted the anti-inflammatory activity significantly when compared to the standard drug.

Senthamarai Selvi and Anusha Bhaskar [28] evaluated the anti-inflammatory activity of papaverine from *Sauropus androgynus* L. Merr. [Phyllanthaceae] using experimentally induced inflammatory model in rats. Invitro anti-inflammatory activity by Inhibition of albumin denaturation, Membrane stabilization test, Heat induced hemolytic activity, Protein inhibitory action and invitro anti-inflammatory activity by Carrageenan Induced Rat Paw Edema Method, Antinociceptive activity, Hot-Plate Test. *Sauropus androgynus* showed significant reduction when compared with the standard dose of 100 mg/kg body weight. Papaverine, Morphine which exhibited stronger inhibition than aminopurine in acetic-acid induced abdominal stretching at 100 mg/kg dose.

Parimala and Binoy [29] subjected the petroleum-ether extract of *Eupatorium.triplinerve Vahl* to preliminary phytochemical screening. The acute anti-inflammatory effect was studied by carrageenan induced hind paw edema method in rats. Acute toxicity studies showed that the extract was non-toxic up to a maximum dose of 2000 mg/kg body weight. Petroleum-ether extract exhibited significant inhibition of acetic acid induced writhing, reduced the paw-licking response time significantly in formalin test and increased the withdrawal latency time in tail immersion test. Carrageenan induced hind paw edema was significantly reduced in rats. The present study indicated that the petroleum-ether extract of *Eupatorium triplinerve Vahl* has potential antinociceptive and anti inflammatory activity.

Sreena et al [30] evaluated the anti- inflammatory and antiarthritic studies of the compound isolated from the methanolic extracts of *Clinacanthus siamensis*. The structure of the isolated compound was confirmed by spectral analysis and the compound isolated may be 4,5-dinonyl-1,3-dioxolane. The compound showed significant anti-inflammatory activity in Carrageenan induced paw edema model and the maximum inhibition was to the extent of 37.98% at 180 minutes of administration [$p < 0.001$]. The compound at 0.5 mg/kg doses produced a significant inhibition in formalin induced arthritis and the effect produced was 22.17 % [$P < 0.05$].

Rahman et al [31] investigated the analgesic and anti-inflammatory effects of *Ageratum conyzoides* and *Emilia sonchifolia* alcoholic extracts in animal models. Anti-inflammatory effect was investigated in carrageenan induced anti-inflammatory paw edema model of Wistar albino rat. Data were analyzed by one-way analysis of variance [ANOVA], followed by Tukey's post hoc test for multiple comparisons. In a dose-dependent response, *A. conyzoides* and *E. sonchifolia* extracts inhibited 49.85 and 39.47% of acetic acid induced pain at the highest dose 2.0 g/kg body weight [BW]. These effects were statistically significant [$P < 0.05$] as compared to the reference drug, diclofenac sodium [40 mg/kg]. *A. conyzoides* reduced 35.48% and *E. sonchifolia* reduced 38.70% of formalin induced pain by 2.0 g/kg which were also statistically significant [$P < 0.05$] as compared to morphine [0.5 mg/kg]. In a time-dependent inhibition of carrageenan induced paw edema model, the extracts of *A. conyzoides* and *E. sonchifolia* promoted 50.23 and 48.11% inhibition of paw edema at the 4th hour of administration, respectively and the effects were statistically significant [$P < 0.05$]. No mortality was observed in acute toxicity test.

Azadmehr A and Goudarzvand M [32] evaluated the therapeutic effect of *Scrophularia megalantha*, a medicinal plant of Iran, on myelin oligodendrocyte glycoprotein 35-55 [MOG]-induced experimental autoimmune encephalomyelitis [EAE] as a model of multiple sclerosis [MS]. The ethanol 80% extract of *S. megalantha* aerial parts was prepared by maceration method. The extract [100 mg/kg/day] was administered to C57BL/6 mice immunized with MOG [35-55] for 7 days, 3 weeks after EAE induction. The mice brain was removed and Hematoxylin-Eosin [H&E] was used to stain the sections. Moreover, spleen mononuclear cells from extract-treated or non-treated of EAE model mice were stimulated with MOG peptide and then culture supernatants were evaluated for IFN-ɣ, IL-17 and IL-10 cytokines using Enzyme-Linked Immuno Sorbent Assay [ELISA] kits. Treatment with *Scrophularia megalantha* areal part extract significantly reduced inflammatory cells infiltration in the central

nervous system [CNS] and also the disease severity in the experimental model of MS. The study also indicated that treatment with this medicinal plant in EAE mice model significantly decreased inflammatory cytokines including IFN-ɣ and IL-17 and vice versa significantly increased IL-10 as anti-inflammatory cytokine compared with non-treated of EAE model mice group. These findings suggested that this medicinal plant has the anti-inflammatory and immune-modulatory effects.

V. ANTI OXIDANT ACTIVITY:

Kanniappan et al [33] carried out the antioxidant potential of *Aerva lanata*. Based on the phytochemical screening aqueous, ethanol and aqueous ethanol extract were selected. The plant exhibited the most potent radical scavenging activity at a maximum concentration 2.5mg/ml. Natural antioxidants such as flavonoid, total phenols, tannin, carotenoids and lycopene were evaluated and also the antioxidant activity against DPPH, Super oxide anion, Hydroxyl radical, Nitric oxide radical, Hydrogen peroxide radical, Total antioxidant capacity assay and anti-lipid peroxidation activity were evaluated. *Aerva lanata* showed high anti lipid peroxidation against TBA. Strong antioxidant activity showed in aqueous ethanol extracts than water and ethanol extracts, and similar to standards ascorbic acid and BHT.

Shubharani et al [34] stated, *Baliospermum montanum* [wild] Muell. is used in India for reducing oxidative stress. The main objective of the study was to investigate phytochemical and antioxidant activities to justify the use of this plant in medicines. Antioxidant activity of different concentrations of methanolic leaf extract was evaluated with the determination of total phenolic, DPPH* radical scavenging assay, and ABTS+ decolouration assay. The total phenolic content was higher in this extract. The antioxidant potential of the extract was well established with DPPH*, which provide a basis for the traditional use of this plant in medicines.

Ratnam et al [35] subjected the antioxidant potential of *Curculigo orchioides* by three different established invitro methods DPPH, Reducing Power and Phosphomolybdenum assay. Gallic acid was used as reference standard. The results obtained showed ethanolic root extract of *Curculigo orchioides* possess significant free radical, reducing power, antioxidant activity in a concentration dependant manner. The results revealed that ethanolic root extract of *Curculigo orchioides* possess significant antioxidant activity.

Hegde Chaitra and Madhuri [36] investigated the antimicrobial properties, phytochemical analysis and antioxidant potential of leaf extracts of *Punica granatum L.* Total antioxidant potential of the methanolic and aqueous extracts were found as 2.26 and 1.06 mg of ascorbic acid equivalent per ml of the extract respectively. The results indicated that the methanolic extract of the leaves are pharmacologically more active than the other extracts.

Sneh Verma et al [37] investigated the ornamental plants, *Araucaria cookii*, *Bauhinia blakeana* and *Brassaia actinophylla*. Maximum antioxidant activity was seen in methanol extract of *Brassaia* actinophyla with 81% inhibition. The order of the antioxidant activity of the three plants are in the order *B.actinophylla>A cookie>B.blakeana*. The results of phytochemical analysis suggest that phytosteroids are present in all the three plants. Maximum inhibition against the tested enzymes was exhibited by hexane and chloroform extracts of *A.cookii*. Hemolytic activity was done and the hexane extract showed maximum haemolysis where as aqueous extracts showed minimum activity.

Rohita Singla and Saroj Kumar Pradhan [38] reported the maximum content of phenolics were in *Ageratum conyzoides* [flower, 9.51±0.00 mg CA/g DW], *Launaea procumbens* [stem, 7.94±0.01 mg CA/g DW], *Ranunculus muricatus* [flower, 7.15±0.07 mg CA/g DW] and *Sonchus asper* [flower, 8.12±0.34 mg CA/g DW]. The flavonoid content was measured high in case of *Silybum marianum* [stem, 4.83±0.00 mg Q/g DW], *Ranunculus muricatus* [leaves, 2.96±0.01 mg Q/g DW], *Solanum nigrum* [leaves, 2.45±0.03 mg Q/g DW] and *Ageratum conyzoides* [leaves, 2.15±0.01 mg Q/g DW]. All the species of weeds having high phenol and flavonoid content also have strong antioxidant potential in terms of DPPH radical scavenging activity and total antioxidant capacity.

Amit Keshav, Alok Sharma and Bidyut Mazumdar [39] carried out the phytochemical analysis of *Colocasia esculenta* [L.] leaf using three solvents [methanol, chloroform and ethanol] with soxhlet apparatus. Phytochemical constituents were abundant in the leave extract. Leaf was found to have various phytochemicals such as alkaloids, glycosides, flavonoids, terpenoids, saponins, oxalates and phenols etc. In order to find the antioxidant activity of the extract, DPPH [2,2-diphenyl-1-picrylhydrazyl] method was employed using ascorbic acid as standard. DPPH scavenging activity of ascorbic acid was found to be 84%, whereas for ethanol it was observed to be 78.92%, for methanol: 76.46% and for chloroform: 72.46%. Looking at the high antioxidant activity, *Colocasia esculenta* may be recommended for medicinal applications. The characterizations of functional groups were analyzed using FTIR spectroscopy.

Hasan et al [40] extracted the rind and aril of pomegranate [*Punica granatum*] using solvents of varying polarity: petroleum ether, dichloromethane, ethyl acetate, methanol and water. Phytochemical investigations included qualitative detection of phytochemicals including phenols and tannins, flavonoids, anthocyanins, coumarins, quinones, saponins, steroids, triterpenoids and alkaloids. Total phenolic and flavonoid content of each extract were determined quantitatively. Methanolic and aqueous pomegranate rind extracts showed highest amount of phenolic and flavonoid content. The presence of gallic acid in pomegranate rind and aril was determined by GC-MS. Medicinal studies comprised of evaluating the antioxidant, antidiabetic and antibacterial potential of the prepared extracts. According to 1,1-diphenyl-2-picrylhydrazyl [DPPH] assay for antioxidant potential, methanolic and aqueous extracts of pomegranate rind and methanolic extract of pomegranate rind showed antioxidant activity of above 80%. Aqueous extract of pomegranate aril showed highest inhibition of alpha-amylase which was taken as antidiabetic activity according to 3,5-dinitrosalicylic acid assay [DNSA assay]. Methanolic and aqueous extracts of pomegranate rind were most effective in inhibiting the growth of a number of bacteria according to the disc diffusion method.

Enayati A and Khori V [41] investigated the antioxidant activity of aerial parts and root of *Potentilla reptans* and the cardio protective role of its root on preconditioning ischemia reperfusion injury . Antioxidant activity of aerial parts and root of this plant were measured by DPPH and FRAP methods and its total phenolics content was estimated by Folin-Ciocalteu assay.

Catechin was isolated from ethyl acetate fraction by Paper chromatography. Cardioprotective role of *P. reptans* root were evaluated by thirty five rats in five groups. The hearts were subjected to 30 minutes of ischemia and 100 minutes of reperfusion. The ischemic preconditioning [IPC] protocol was applied before the main ischemia. The myocardial infarct size was estimated by triphenyltetrazolium chloride [TTC] staining. The hemodynamic parameters, arrhythmia scoring and coronary flow were measured during reperfusion. *Potentilla reptans* root showed stronger antioxidant activity and total phenolics content compared to the aerial parts. Total extract of root significantly decreased the infarct size and increased coronary flow in a concentration dependent manner.

Vasanthi et al [42] evaluated the phytochemical constituents and antioxidant activity of leaf and bark extracts of *Albizzia lebbeck.* Antioxidant activity was carried out using 1,1-diphenyl-2-picrylhydrazyl radical [DPPH] and Nitric oxide. The phytochemical screening of leaves and barks of *A. lebbeck* revealed the presence of phenols, steroids, tannins, saponins and alkaloids in the hydro alcohol extract. The percentage yield of hydro alcohol extract of the leaf of *A. lebbeck* was higher [13.55] than that of the bark. Also quantitative analysis showed that percentage of phenols was higher [17.47] in the leaf extract. The results of DPPH scavenging activity for leaf hydro alcohol showed [14.87%] and bark hydro alcohol showed [12.95%]. When compared to standard the leaf hydro alcohol showed better activity [14.84%]. The percentage antioxidant activity is high in leaf extract than bark extract and in Nitric oxide assay the percentage inhibition was also higher than the bark extract when compared to the Ascorbic acid [standard]. It indicates that hydro alcohol leaves extract the plant has the potency of scavenging free radicals and it may provide leads in the ongoing search for natural antioxidants from various medicinal plants to be used in treating diseases related to free radical reactions.

VI. CONCLUSION:

The knowledge of the properties of medicinal plants has likely been on to natives by their elders or is based on experience. Plants have played a significant role in human health care since the ancient times. Traditional plants exerts great role in discovery of new drugs. Majority of human population worldwide is getting affected by inflammation related disorders. Hence, it is a need of time for herbal medicines should consider for determination of their pharmacological activities, isolation of single entity responsible for anti-microbial, anti-bacterial, anti-inflammatory and anti-oxidant activity and development of suitable formulation which would be beneficial against these disorders. So this review helps to new researchers.

VII. CONFLICT OF INTEREST

The authors declare no conflict of interest.

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