DISCUSSION

Medicinal plants and its molecular mechanism of action has become a topic of global importance. Plants are indispensable to man for his life. Abuse of nature's law upset the human system and ends up in fatal diseases. Nature is the best combinatorial chemist and possibly has a complete storehouse of remedies to cure all diseases of mankind (Jachak et.al, 2007). Home remedies are a form of traditional medicine. These home remedies are time tested and of proven efficacy. The contribution of traditional medicine to "Health for all" is potentially very great, because they are culturally accepted and economical. Appropriate treatment of common injuries is one of the important elements of primary healthcare. Such injuries are most commonly seen in childhood and mother commonly treat such injuries with home remedies. In olden days a medicine prescribed by a hermit (Faqir) earned more reputation than one based on some tests and experiments (Jain, 1968).

Human being appears to be afflicted with more and more diseases than any other animal species. He very early sought to alleviate his suffering by taking advantage of plant growing around him. It is indeed a tribute to the richness of sages in India that even after lapes of several centuries, Ayurveda and other ancient sciences are still respected for their therapeutic values. The basic strength of these systems lies in the relatively low coast, freedom from side effects and close rapport possible between traditional practicener and patients. To day herbal cosmetic and Ayurvedic medicine are venture in the World. Global estimate indicate that ¾ of the World population can not afford the products of Western pharmaceutical and have to rely upon the use of traditional medicine. Even after induction of modern system of medicine 90% of population in rural India takes help of Local village health practicener (LVHP) for treatment of various diseases (Yadav, et al., 2001).

Plant derived medicines have been a part of our traditional health care system and antimicrobial properties of plants derived compounds are well documented. There is an

increasing tendency to opt for therapeutic agent from natural resources. In Asian countries traditional system of medicine has been an important part of healthcare delivery system. As a result of strategy to reduced financial burden on developing countries which spend 40-50 % of their total health budget on drugs. India thus can lead a long way and produce a socio economic revolution with its rich traditional medical practice. There is a dire need for traditional medical practiceners to develop effective, safer and stable formulations for various diseases. W.H.O also recommends and promotes the inclusion of herbal drugs in National health care delivery system. The knowledge of these medicines passes on to the generation usually through oral teaching thereby restricted to particular family, tribe or section of society which has led them to the verge of extinction. But now a day ethno biologists have taken a positive step to bring them at frontier of science and technology.

Man and microbes have had a long standing love'n hate relationship on this planet. A microbe touches human life in many ways and thus plays a paramount role in shaping the man's destiny. Diseases and deaths have always attracted the attention of human mind. Recent annual report from W.H.O. have identified that $1/3^{rd}$ of total deaths in the World are caused by infectious diseases. Emergence of new pathogens through their adaptation and genetic alteration now poses a new challenge to treating physicians (Chugh, 2006).

Millions of infants die of bacterial, viral and protozoan infections and antimicrobial resistance and hospital associated infections are causing considerable alarm. New agent of infectious diseases continues to recognize. Some infectious diseases once though to be conquered have returned with vengeance (Arora, 2006).

To day's physician in his widest imagination would not be able to picturize a world with out antimicrobials. Survival is the essence of nature and bacteria and fungi in their effort to survive the onslaught of antimicrobials have developed resistance which continues to increase inexorably. For an antimicrobial to be effective against given micro-organism, three conditions must be met.

1. A vital target susceptible to a low concentration of antimicrobial must exit in the microbes.

2. The antimicrobial must penetrate the surface of micro-organisms and reach the target in sufficient quantity.

3. The antimicrobial must not be inactivated or extruded before binding the target.

There are four main mechanism by which bacteria may circumvent the action of antimicrobial agents (Harvey 1997; Hawkey, 1998).

1. Specific enzymes may inactivate or modify the drug before or after it enter the bacterial cell; e.g. Beta-Lactamases.

2. Bacterial cell envelope may be modified so that it becomes less permeable to the antibiotic.

3. Drug may be actively expelled from the cell.

4. The target may be modified so that it binds less avidly with the antibiotic. e.g. In case of *S. pnemoniae*.

Continued increased in antibiotic resistance has fueled the development of new antibiotics, the introduction of which may help to alleviate the situation assuring effective treatment in resistant cases. In mid 1970s the development of some of Beta-lactamase mediated drug resistant has become a major therapeutic problem in iinfection caused by enterobacteraceae and Staphyllococci. Clinical pathogen world wide posses a vast armoury of beta-lactamases, the genetic determinant for many of which can be transformed from one bacterial to another. Beta lactamase hydrolyse the amide bond in Beta-lactam ring of penicillin and cephalosporin producing acid derivatives, (Lambart et al, 1997); which has no antibacterial properties.

Many of the health problems in developing countries like India are different from developed countries. Bacterial diseases still play a considerable role in diseases in our country. By the beginning of 20^{th} century many infectious diseases have been proved to

have been caused by microorganisms. In recent years bacterial drug resistance to human bacteria has been commonly reported all over the World. However situation is alarming in developing as well as developed countries due to the indiscriminate use of antibiotics. Fungal pathogen has further complicated the treatment of infectious diseases in immuno-compromised, AIDS, and cancer patients (Rinalds, 1990; Diamond, 1993).

Mostly antibiotics are prescribed merely on the assumption of probable organism causing a particular infection with out culture and sensitivity. The continuous use of antibiotics some time associated with adverse side effect on host like hypersensitivity. Fleming (1929) made the accidental discovery that fungus penicillium produces a substance which destroys Staphylococci. It was only the need brought about by Second World War that led to the isolation of active substance penicillin and its subsequent mass production. This was the beginning of the antibiotics era. Other similar antibiotics were discovered in rapid succession with the sudden availability of wide range of antibiotics with potent antibacterial activity. It was hoped that bacterial infections would be controlled with in a short period, but soon the development of drug resistance bacteria presented serious difficulties. With the development of wide varieties of antibiotics against whole spectrum of bacteria and effective vaccination against most viral diseases, expectations were raised about the eventual elimination of all infectious diseases.

Resistance to antimicrobial agent has resulted the morbidity and mortality from treatment failure and increased health care coast. Appropriate antimicrobial drug use has unquestionable benefit, but physicians and public frequently use these agents inappropriately. The availability of antibiotics over the counter, despite regulation to the contrary also fuels the problem. Easy availability if antimicrobial drugs leads to their incorporation in to herbal or folk remedies which also increases the inappropriate use of these agents (Lalitha, 2001).

Inappropriate or excessive use of antimicrobial drugs by a person or practicener can affect the entire ecological system and can not be condemned. United efforts needed to fight resistance (Beta-Watch).The problem of resistance to antimicrobial drugs is particularly important in countries where conditions are poor and resources are scarce.

The focus in these developing countries should be on the availability of the safe and effective drugs and on the enforcement of more responsible national policy (Kunin CM, 1993). In order to counter the problem on drug resistance national policies need to be developed to ensure better quality control, proof of safety and efficacy and assurance of patent protection. The situation in developing countries will get worse unless govt. become more stable, major advances occurs in standard of living, and preventive as well as reactive health care are provided. No one group or country can accomplish these objectives alone and united effort is there fore required. It is in the interest of developed countries to support such initiation as resistant microorganisms do not recognize geographical boundaries. Attention should be focused on social issues that determine how antimicrobial drugs are used and physicians must ensure a more selective and rational use of antibiotics in hospital and community. We need to be selective in the use of antimicrobial drugs; we must never use them for trivial indication.

In the present study 18 plants namely: *A. aspera*, *A. tunifolius*, *C. fistula, C. indica*, *C. reflexa*, *C. sativa, E. hirta*, *E. prostrata*, *H. integrifolia*, *H. zeylanicum*, *K. pinnata*, , *L. cehalotes, P. niruri*, *S. xanthocarpum*, *S. nigrum*, *P. minima*, *T. erecta*, *T. procumbens* were taken to find out the antimicrobial activity (Table 58 & 59). Out of the 18 plants, the plant extracts of *K. pinnata* did not reveal antimicrobial activity in any extract. The extracts obtained in petroleum ether from most of the plants also did not reveal antimicrobial activity. The plants extracts of *A. aspera*, *A. tunifolius*, *C. fistula, C. indica*, *C. reflexa*, *C. sativa, E. hirta, T. erect* and*, L. cephalotes* exhibited promising antimicrobial activity.

A leaf extract from *A. aspera* collected from different areas of the United Arab Emirates was tested against Gram-positive bacteria. It showed inhibition against *S. aureus*, *B. subtilis*, *E. coli* and *A. terreus*, respectively. The root extract was less active (Bashir et al., 1992). Another study was done on leaf and stem parts of *Achyranthes aspera* in different organic solvents (namely methanol, ethanol, ethyl acetate and chloroform) extract to evaluate the antimicrobial activity against *E. coli*, *B. subtilis*, *V. cholerae*, *S. typhi* and *S. aureus* at a concentration of 5 mg/ml (Alam et al., 2009). No antibacterial activity of the organic extracts of *A. aspera* was observed against the above

bacteria in the study. The antifungal activity of ethanol leaves extract of *A. aspera* showed high antifungal activity against *C. kefyr, C. neoformans, A. niger* and *A. flavus*. The methanol leaves extracts showed high antifungal activity against *C. neoformans* and *A. flavus* but aqueous leaves extract did not show antifungal activity against tested fungal strains. Similarly in our study we also did not found any antibacterial activity against *E. coil* and *S. typhi* but the antibacterial activity was showed by ethanol (14mm) and methanol extract (15 mm) against *V. cholera* and Ethanol (16 mm), methanol (14 mm), aqueous extract (14 mm) against *S. aureus* (Table 58 & 59). No antifungal activity was showed by any organic solvents extracts against *C. albicans* and *A. niger*.

Vaghasiya and Chanda (2007) evaluated the antibacterial activity of methanol and acetone extract of leaves and stem of *A. tenuifolius* by measuring the zone of inhibition and found that the methanol extract exhibited antibacterial activity against *S. aureus* (9 mm), *Bacillus cereus* (13 mm), *Clostridium freundii* (10 mm) and acetone against *K. pneumonia* (17 mm) bacteria at concentration of 2mg/ disc. The methanol extract of *A. tenuifolius* have also revealed antifungal activity against *Candida tropicalis* with inhibition zone of 11 mm. We have observed the antibacterial activity of ethanol (13mm), methanol (14) and aqueous extract (12 mm) against *S. aureus*. In our study the antibacterial activity was also found in ethanol, methanol and aqueous extract against *P. aeruginosa*, *P. mirabilis*, *S. typhi*, *S. flexneri* and *V. cholera* (Table 58).

Crude methanol extracts from leaves of *Cassia fistula* was investigated for their antifungal activities on three pathogenic fungi (*Microsporum gypseum, Trichophyton rubrum* and *Penicillium marneffei*). The extract of *C. fistula* was the most potent inhibitor of *P. marneffei* with the IC_{50} of 0.9 mg/ml (Phongpaichit et al., 2004). In the present study, petroleum ether and ethanol extract of *C. fistula* showed antifungal activity only against *C. albicans* and methanol extract was found to be completely ineffective against all fungal strains. Similarly in other study, hexane, chloroform, ethyl acetate, methanol and water extracts from the flower of *Cassia fistula* (an ethnomedicinal plant) were tested against bacteria and fungi. All the extracts exhibited antibacterial activity against Gram-positive organisms with minimum inhibitory concentrations (MIC) between 0.078 and 2.5 mg/ml. Among the Gram-negative bacteria, only *Pseudomonas aeruginosa* was

susceptible to the extracts. Ethyl acetate crude extract was fractionated using chromatographic techniques. A crystal was isolated, which was confirmed as 4-hydroxy benzoic acid hydrate using X-ray crystallography. It exhibited antifungal activity against *Trichophyton mentagrophytes* (MIC 0.5 mg/ml) and *Epidermophyton floccosum* (MIC 0.5 mg/ml). However, in our study, none of the extract exhibited antimicrobial activity against *P. aeruginosa*.

Shaheen et al (2009) studied the antimicrobial activity of different extracts of *Coccinia indica* fruits against pathogenic Gram Positive and Gram negative bacteria from Warangal district of Andhra Pradesh. The crude extracts of *C. indica* exhibited moderate to significant antibacterial activity against all the tested bacteria with inhibition zone ranging from 1- 19 mm. The organic extracts (Petroleum ether and methanol) showed the highest against the *S. aureus*, *B. cereus*, *P. sputida*, *S. pararyphi* A, *S. pararyphi* B, *Klebsiella pnenmoniae.* The present study revealed the moderate activity of methanol extract against *S. aureus*, ethanol and methanol extract against *P. aeruginosa* and methanol and water extract against *P. mirabilis* (Table 58 & 59).

Pal et al (2006) studied the antibacterial activity of methanol extract of *Cuscuta reflexa* stem which showed the broad spectrum antibacterial activity. Chhabra et al (2010) studied the antimicrobial activity of using aqueous and various organic solvents viz. benzene, acetone, ethanol and methanol extracts of *C. reflexa* growing on different sources (*Acacia arabica* and *Zizyphus jujube*) against gram positive bacteria (*Staphylococcus aureus* & *Staphylococcus epidermidis*), gram-negative bacteria (*Escherichia coli* & *Pseudomonas aeruginosa*) and fungus (*Aspergillus niger*). The study showed a strong inhibitory effect of ethanol and methanol extracts of *C. reflexa* (jujuba and arabica) on most of the gram positive and gram negative bacteria. The aqueous extract of *C.reflexa* (arabica) failed to show any antimicrobial activity while *C.reflexa* (jujuba) showed very little effect. In the present study the ethanol and methanol extracts showed the antibacterial activity against *S. aureus* and *Vibrio cholerae* while the water extracts revealed the activity against *S. aureus* and *V. cholerae* (Table 58). In the present study antifungal activity of ethanol and water extracts has also been reported against fungus *C. albicans.*

In vitro antimicrobial studies were conducted with aqueous, ethanolic and petroleum ether extracts of the leaves of *Cannabis sativa* from Pakistan by Wasim et al (1995). The ethanolic and petroleum ether extracts exhibited activity against gram positive bacteria (*B. subtilus*, *B. pumilus*, *S. aureus*, *M. flavus*), gram negative bacteria (*P. vulgaris* and *Bordetella bronchioseptica*) and fungi *A. niger* and *C. albicans*. The water extracts did not exhibit activity against any microbes. Our study revealed the antibacterial activity against the bacteria *S. aureus*, *K. pnenmoniae*, *S. flexneri* and *V. cholerae* by ethanol, methanol and water extract. The present study is contrary to studied made by Wasim et al where the water extracts did not exhibit activity and petroleum ether extracts exhibited activity but in the present study water extract showed the antibacterial activity and petroleum ether extracts did not exhibit the activity against any bacteria and fungi.

The methanol, hexane and water extract of *Euphorbia hirta* was investigated against *Escherichia coli*, *Klebsiella pneumoniae. Shigella dysentriae, Salmonella typhi* and *Proteus mirabilis.* The Minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) values ranged from 25 to 100 mg/ml (Abubakar, 2009). The ethanolic extract of *E. hirta* inhibited the growth of the *E. coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Bacillus subtilis* and aqueous and chloroform leaf extracts of *E. hirta* possess an antibacterial activity against *Klebsiella pneumonia*. The extract is noncytotoxic and antibacterial (Suresh et al, 2008). Another study on *Euphorbia hirta* L. (Euphorbiaceae) ethanol, methanol, chloroform and aqueous (water) extracts of leaf, stem, root and whole plant was done to evaluate antibacterial activity. The agar-well diffusion assay was employed against several Gram-positive (*Bacillus subtilis* and *Staphylococcus aureus*) and Gram-negative (*Escherichia coli, Klebsiella pneumoniae* and *Proteus vulgaris*) bacterial species. Aqueous and chloroform extracts of stem and root did not express any activity. Antibacterial activity was recorded in the order of ethanol, methanol, aqueous and chloroform extracts. Among these extracts ethanol and methanol extracts of leaf and whole plant were more effective and significant than aqueous and chloroform extracts in inhibiting the growth of the pathogenic bacteria under study, but were less potent when compared to that of tetracycline used as positive control. Phytochemical screening of the plant revealed the presence of tannins,

flavonoids, alkaloids, glycosides and saponins (Aniel et al, 2010). Our study on *E. hirta* whole plant methanol and aqueous extracts revealed good antibacterial against all the tested bacteria except *K. pneumoniae* as shown by zone of inhibition and MIC values. However, antifungal activity has not been observed in any of the extracts of *E. hirta* (Table 58 & 59).

Rene *et al*, (2010) evaluated the antibacterial activity of aqueous and ethanol extracts of *Euphorbia prostrata* against *Shigella dysenteriae*. The aqueous ethanol extract of *E. prostrata* was not toxic. *In vitro*, the minimal inhibitory and minimal bactericidal concentrations of the extract were 3,500 and 12,000 µg/ml, respectively. In the present study only the aqueous and ethanolic extract of *E. prostrata* revealed against bacteria *S. flexneri* with inhibition zone of 18 mm and 14 mm respectively with MIC values of 2000 µg/ ml for each (Table 58 and 59).

Reddy et al, (2008) valuated the wound healing and antibacterial potentials of *Holoptella integrifolia.* The methanolic extract of leaves and stem bark was studied for antimicrobial activity against six bacterial and five fungal strains. The methanolic extract of stem bark has shown bigger zone of inhibition (11.3- 20.4 mm) than methanolic extract of leaves. In the present study the ethanol, methanol and aqueous extracts of leaves have shown the promising antibacterial activity against *P. mirabilis* and *S. flexneri*. Aqueous extract showed 14 mm zone of inhibition but large zones of inhibition in ethanol and methanol (17 mm) has been observed against *P. mirabilis*. In case of *S. flexeri* the zone size ranges from 15- 18 mm (Table 58).

H. zeylanicum extracts as well as isolated alkaloids have shown antimicrobial activity in test with the bacteria *E. coli*, *S. pnemoniae*, *B. subtilis*, *B. anthracis* and *S. aureaus* and fungi *A. fumigatus*, *A. niger*, *Rhizoctina phaseoli* and *P. chrysogenum* (Schmelzer and Gurib-Fakim, 2008) The present study revealed the antibacterial activity against *S. aureaus* by the ethanol, methanol and aqueous extracts and against K. *pnemoniae* by aqueous extract only.

In a study the aqueous extracts of the stem bark of *Kigelia pinnata* was investigated for its antimicrobial activities against *B. subtilis, E. coli, P. aeruginosa, S.*

aureus and *C. albicans*. The crude aqueous extracts showed significant antimicrobial activity (Akunyili et al., 1991). But in our study the flower methanol, aqueous, ethanol and petroleum ether extracts did not reveal any antimicrobial activity against bacteria and fungi.

The aqueous extracts of the stem bark of *Kigelia pinnata* was investigated for its antimicrobial activities against *B. subtilis, E. coli, P. aeruginosa, S. aureus* and *C. albicans*. The crude aqueous extracts showed significant antimicrobial activity (Akunyili et al., 1991). But in our study the flower methanol, aqueous, ethanol and petroleum ether did not shown any antimicrobial activity against bacteria and fungi.

The results of antimicrobial activity of methanolic extract of whole herb plant of *Leucas cephalotes* showed highest activity against *Bacillus cereus and Shigella flexineri* but found negative against *Candida albicans.* Another Toluene extract of the plant found totally negative against all the strains. Methanolic extract have shown the 59% and 41% zone of inhibition on the bacterial strains and on the fungal strains respectively when compared to the standards (Antariksh *et al*, 2010). In the present study aqueous, methanol and ethanol extract reveled antibacterial activity against *S. aureaus*, aqueous extract against *P. aeruginosa*, methanol extract against *V. cholerae* and aqueous extract against *S. marcescens* (Table 58-59). The aqueous extract also revealed antifungal activity against *A. niger* but not against *C. albicans*.

The antibacterial activity of *P. niruri* against *E. coil*, *S. aureus* and *S. typhi* was observed in hot water, cold water and ethanol extracts and found the inhibitory effects against *E. coil*, *S. aureus* and *S. typhi*. The maximum antibacterial was observed in ethanol extract against *E. coil* (12mm), *S. aureus* (14mm) and *S. typhi* (12mm) (Ekwenye and Njoku, 2006). Another study revealed the antimicrobial activity of the extracts of *P. niruri* against four gram negative and one gram positive bacteria. The results showed that the aqueous and ethanolic extracts of *P. niruri* showed high inhibition against *S. aureus, E. coli* and *S. typhi* with MIC 50 µg/ml against *S. typhi* and *S. aureus* (Sumathi and Parvathi, 2010). Similar to above study we have also found good antibacterial activity of ethanol (16mm) methanol (14mm) and aqueous (14mm) extracts against *S. aureus*, *S.*

flexneri and *V. cholerae*. But no inhibition was observed against *S. typhi*. Our study also revealed the strong antifungal activity in ethanol extract against A. *niger*.

Dabur et al., (2004) studied the fourteen Indian plants for estimation of potential activity against fungi. The study found that the methanolic extracts of *S. xanthocarpum* inhibited the growth of *Aspergillus fumigatus*, *A. flavus* and *A. niger* with MICs ranged from 1.25 mg/ml to 2.50 mg/ml. The MIC was found by using the percent spore germination assays. In contrast to above study we observed very high MIC (32 mg/ml) in methanolic extract against *A. niger* by using the micro broth dilution method for estimation of MIC (Table 58 and 59).

Al-Fatimi et al., (2007) investigate ninety crude extracts, including dichloromethane, methanol and aqueous extracts from 30 medicinal plants used in the Yemeni ethnomedicine to treat common infections, for antimicrobial activities against three Gram-positive bacteria and two Gram-negative bacteria, *Candida maltosa* and five opportunistic human fungal pathogens. In the above study *Solanum nigrum* fruits showed antimicrobial activity against almost all microbes with MIC ranges from 2 mg/ ml to 50 mg/ ml. In contrast to above study we found that the antibacterial activity of whole plant of *S. nigrum* only against *S. aureus* and antifungal activity against *C. albicans* with MIC ranged between 2 mg/ ml to 32 mg/ ml (Table 58 and 59).

In a study, the *in vitro* antimicrobial activity of *Physalis minima* leaf and callus extracts were studied against selected pathogenic fungi and bacteria, following broth dilution assay (Shariff et al, 2006). The absolute alcohol, benzene, chloroform, methanol and petroleum ether extracts were found to be more effective against *B. subtilis, E. coli, P. solanacearum, X. axonopodis X. vesicatoria* and fungi like *A. ochreaceous, A. flavipes,* and *F. verticilloides*, where the minimum inhibitory concentration (MIC) ranged between 0.25 to 6 mg/ml. But in our study antibacterial activity was exhibited by ethanol, methanol, aqueous extract with MIC ranged between 2 to 32 mg/ml against *P. aeruginosa* and no antibacterial was observed against other bacteria and fungi. In another study the dried fruits of *Physalis minima* extracted with different organic solvents such as acetone, benzene, chloroform, hexane, methanol and petroleum ether and tested for their

antibacterial activity against *B. subtilis*, *B. megaterium*, *E. coli*, *E. faecalis*, *P. aeruginosa* and *S.aureus*. Acetone and chloroform extracts showed activity against tested pathogens but no antibacterial activity was exhibited by the petroleum ether (Barijwal et al., 2010). Similar to above study we did not found any antibacterial activity of petroleum ether against microbial species.

Gupta and Vasudeva (2010) investigate five successive extracts (petroleum ether, chloroform, ethyl acetate, methanol and aqueous) of the roots of *T. erecta* for *in vitro* antimicrobial activity against seven microbial strains. All extracts exhibited significant antimicrobial activity against three Gram-positive and two Gram-negative bacterial and two fungal strains with MIC values ranging between 12.5-100 microg/mL. In our study the ethanol extract exhibited antibacterial activity against *S. aureus* (19 mm, MIC 4mg/ml), *P. aeruginosa* (12 mm, MIC 8mg/ml), *P. mirabilis* (13mm, MIC 8mg/ml) and the methanol extract exhibited antibacterial activity against *S. aureus* (18mm, MIC 4mg/ml), *P. aeruginosa* (14mm, MIC 8mg/ml) and *P. mirabilis* (16mm, MIC 8mg/ml). Similarly the aqueous extract exhibited antibacterial activity against *S. aureus* (10 mm, 4mg/ml), *P. mirabilis* (11 mm, MIC 16mg/ml and *S. flexneri* (14 mm, MIC 16mg/ml) (Tables 58-59)

The % age activity of plant extracts have been shown in Figure 1 and Table 60, which showed the maximum % age activity (63.63%) of ethanol extract in *A. tunifolius* followed by 36.36% which was found in *P. niruri* and *C. sativa*. The methanol extract showed maximum % age activity in *E. hirta* (63.63%) followed by *A. tunifolius* (36.36%) and aqueous extracts showed maximum activity 54.54% in *E. hirta.* So we found all three extracts ethanol (63.63%), methanol (63.63%) and aqueous (54.54%) of *A. tunifolius* showed their %age activity. The %age activity petroleum ether extracts was found only in *C. fistula* (9.09).

Table 60 : %age activity of medicinal plants in different solvents extracts.

Plant Species	Control	P. ether	Ethanol	Methanol	Aqueous
A. aspera	100	0	27.27	27.27	18.18
H. integrifolia	100	0	18.18	18.18	18.18
C. fistula	100	9.09	27.27	9.09	18.18
C. reflexa	100	0	18.18	9.09	27.27
T. procumbens	100	0	0	0	27.27
C.indica	100	0	18.18	36.36	9.09
P. niruri	100	0	36.36	27.27	27.27
H. zeylanicum	100	0	9.09	9.09	27.27
E. prostrate	100	0	9.09	0	9.09
T. erecta	100	0	27.27	27.27	27.27
A. tunifolius	100	0	63.63	63.63	54.54
L. cepholotus	100	0	47.2	9.09	27.27
E. hirta	100	0	0	72.72	63.63
C. sativa	100	0	36.36	45.45	54.54
S. xanthocarpum	100	0	18.18	18.18	18.18
S. nigrum	100	0	0	18.18	18.18
P. minima	100	0	9.09	9.09	9.09

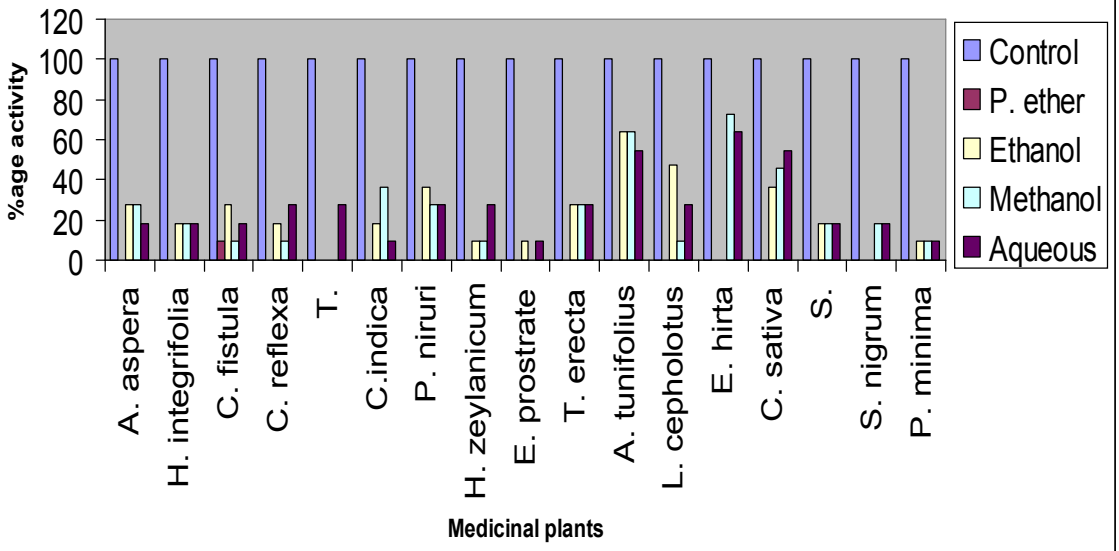

Figure 1 comparison of %age activity of different medicinal plants

A study was done in India on antibacterial activity of aqueous residues of 16 different ethno medicinal plants against three gram positive bacteria and seven gram negative bacteria by the filter paper disc diffusion method. The maximum inhibitions were observed in *Tridax procumbens*, *Cleome viscosa*, *Acalypha indica* and *Boerhaavia erecta* against *Aeromonas hydrophilla* and *Bacillus cerues* (Samy et al., 1991). In our study the microbes tested for antimicrobial activity of *Tridax procumbens* extract was different from the above study but some similarity observed that out of four solvents (petroleum ether, methanol, ethanol and aqueous extract) extract the aqueous extract exhibited antibacterial activity against *S. aureus* (14 mm), *K. pneumonia* (12 mm) and *S. marcescens* (12 mm).

The antibacterial activity of studied plants namely; *A. aspera*, *A. tunifolius*, *C. fistula, C. indica*, *C. reflexa*, *C. sativa, E. hirta, T. erect* and*, L. cehalotes* may be due to presence of various isolated phytochemicals which are known to be synthesized by plants in response to microbial infection (Cowan, 1999).

The mechanism of action of saponins as antimicrobial agents may be due to membranolytic properties, rather than simply altering the surface tension of the extra cellular medium (Killeen, 1998). In our study *A. aspera*, *H. integrifolia, C. fistula, C. reflexa*, *C. indica, E. hirta, T. erect, S. xanthocarpum, P. minima* showed the presence of saponins. The antimicrobial activity of these plants may be due to the presence of saponins.

The presences of tannins were also reported in *A. aspera, C. fistula, C. reflexa*, T. *procumbens*, *C. indica, P. niruri, H, zeylanium, T. erect, L. cephalotus, E. hirta, , S. xanthocarpum,* and *S. nigrum.* The antibacterial activity of tannins may due to their intercalation with enzymes, cell envelope transport proteins and also complex with cell wall polysaccharides (Ya et al., 1988).

Anthraquinones are known to complex irreversibly with nucleophilic amino acids in proteins, often leading to inactivation of the protein and loss of their function in microbes (Stern et al., 1996). We have also noticed anthraquinones in our studied plants of *C. fistula, C. Reflexa, C. indica*, *P. niruri E. prostrata*, *T. erecta*, *A. tunifolius*, *L. cepholotus*, *S. xanthocarpum*, *P. minima* which exhibit antimicrobial activity.

In favor of antimicrobial activity of flavonoids numerous studies illustrated the presence of flavonoids (Cushnie, and Lamb, 2005; Saravanakumar et al., 2009; Alam Sher, 2009) as antimicrobial agents. In our study the presence of flavonoids were also reported in *A. aspera, A. tenuifolius, H. integrifolia, C. fistula*, *C. reflexa*, *T. procumbens*, *P. niruri, T. erecta, S. xanthocarpum* medicinal plants.

The mechanism of action of highly aromatic planar quaternary alkaloids is attributed to their ability to intercalate with DNA (Phillipson and Neill, 1987). The presences of alkaloids have been also noticed in our study in all medicinal plants *A. aspera, H. integrifolia, C. fistula*, *C. reflexa*, *C. indica*, *E. protstrata*, *T. erecta*, *S. xanthocarpum.*

SUMMARY AND CONCLUSIONS

Traditional medicinal practice has been known for centuries in many parts of the world for the treatment of various human ailments. The use of antibiotics has revolutionized the treatment of various bacterial infections. However, their indiscriminate use has led to an alarming increase in antibiotic resistance among microorganisms, thus necessitating the need for development of novel antimicrobials. Recent years have witnessed a renewed interest in exploring natural resources for developing such compounds. Medicinal plants are relied upon by 80% of the world's population, and in India the use of plants as therapeutic agents remains an important component of the traditional medicinal system. A number of plants have been documented for their biological and antimicrobial properties.

Antibiotics provide the main basis for the therapy of microbial (bacterial and fungal) infections. Since the discovery of these antibiotics and their uses as chemotherapeutic agents there was a belief in the medical fraternity that this would lead to the eventual eradication of infectious diseases. However, overuse of antibiotics has become the major factor for the emergence and dissemination of multi-drug resistant strains of several groups of microorganisms The worldwide emergence of *Escherichia coli, Klebsiella pneumoniae, Haemophilus* and many other ß-lactamase producers has become a major therapeutic problem. Multi-drug resistant strains of *E. coli* and *K. pneumoniae* are widely distributed in hospitals and are increasingly being isolated from community acquired infections. *Candida albicans*, also a nosocomial pathogen, has been reported to account for 50-70% cases of invasive candidiasis. Alarmingly, the incidence of nosocomial candidemia has risen sharply in the last decade. All this has resulted in severe consequences including increased cost of medicines and mortality of patients. Thus, in light of the evidence of rapid global spread of resistant clinical isolates, the need to find new antimicrobial agents is of paramount importance. However, the past record of rapid, widespread emergence of resistance to newly introduced antimicrobial agents indicates that even new families of antimicrobial agents will have a short life expectancy.

For this reason, researchers are increasingly turning their attention to herbal products, looking for new leads to develop better drugs against MDR microbe strains.

For thousands of years, natural products have been used in traditional medicine all over the world and predate the introduction of antibiotics and other modern drugs. The antimicrobial efficacy attributed to some plants in treating diseases has been beyond belief. It is estimated that local communities have used about 10% of all flowering plants on Earth to treat various infections, although only 1% have gained recognition by modern scientists. Owing to their popular use as remedies for many infectious diseases, searches for plants containing antimicrobial substances are frequent. Plants are rich in a wide variety of secondary metabolites such as tannins, alkaloids and flavonoids, which have been found *in vitro* to have antimicrobial properties.

In an effort to expand the spectrum of antimicrobial agents from natural resources, eighteen medicinal plants belonging to seventeen families, have been selected based on their traditional uses in Haryana to assess their antimicrobial potential along with minimum inhibitory concentrations, minimum fungal concentrations estimation and preliminary phytochemical estimation of medicinal plants.

SELECTION OF MEDICINAL PLANTS

Plants were selected on the basis of information provided in the ethnobotanical survey and local medicine men **.**On the basis on folklore medicinal properties eighteen medicinal plants were selected in the present study. Their names were *A. aspera*, *A. tunifolius*, *C. fistula, C. indica*, *C. reflexa*, *C. sativa, E. hirta*, *E. prostrata, H. integrifolia*, *H. zeylanicum*, *K. pinnata*, , *L. cehalotes, P. niruri*, *S. xanthocarpum*, *S. nigrum*, *P. minima*, *T. erecta*, *T. procumbens*. Each specimen/ material was collected; labeled, identified and medicinal uses were recorded. The folklore medicinal valve of these plants were following: the cure of urinary troubles, cough, epilepsy, scabies, eczema, Cholera, fever, diabetes, pneumonia, toothache, cuts, wounds, skin diseases, treatment of insect bite, malaria, intestinal worms, leprosy, ringworm, piles, fungal infections, relieve irritable bowels, jaundice, bronchitis asthma, and appetizer. The method used by the traditional healers for the preparation of medicine may vary with type, severity and

location of the diseases. The dose and method on drug intake also varies with the type of disease of the patients. These medicinal plants may be used in various forms like in the form of powder, pellets, decoction, infusion, paste, churns and can be applied topically on the skin or through oral route

IN VITRO ANTIMICROBIAL ACTIVITY

The screening of different plant extracts for their antibacterial activity carried out using Mueller-Hinton and Nutrient agar media did not reveal any significant difference, thus further studies were carried out using nutrient agar medium only. Out of eighteen medicinal plants following mentioned plants exhibited promising antimicrobial activity, *A. aspera*, *A. tunifolius*, *C. fistula, C. indica*, *C. reflexa*, *C. sativa, E. hirta, T. erect* and*, L. cehalotes.*

The antibacterial activity of *Achyranthus aspera* revealed that the ethanol extract exhibit inhibition against *S. aureus* (16 mm), *S. flexneri* (14 mm) and *V. cholera* (14 mm). The aqueous extract shows antibacterial activity against *S. aureus* (14 mm) and *S. flexneri* (16 mm). On the other hand no antifungal activity was found in all four extracts of *A. aspera*. The ethanol extracts of *A. tenuifolius* showed maximum inhibition against *V. cholera* (16 mm) followed by *P. mirabilis* (14 mm), *S. typhi* (14 mm), *S. flexneri* (14 mm), *S. aureus* (13 mm), *P. aeruginosa* (13 mm) and *S. marcescens* (11 mm). In case of *C. fistula* the ethanol extracts exhibited antibacterial activity against *S. typhi* (16 mm), *V. cholera* (16mm). The antifungal activity was also exhibited by ethanol extract against *C. albicans* (22 mm). The aqueous extract shows antibacterial activity against *S. aureus* (16 mm), *S. typhi* (16 mm) and *V. cholera* (13 mm). In case of *C. indica* the ethanol extracts exhibited antibacterial activity against *P. aeruginosa* (12 mm),*V. cholera* (11 mm) and the methanol extract exhibited antibacterial activity against *S. aureus* (15 mm), *P. aeruginosa* (14 mm), *P. mirabilis* (13 mm) and *V. cholera* (12 mm). The antibacterial was exhibited by the ethanol extract against *S. aureus* (15 mm) and antifungal activity against *C. albicans* (16 mm). The methanol extract exhibited antibacterial activity only against *V. cholera* (13 mm) and the aqueous extract exhibited antibacterial activity against *S. aureus* (14 mm) with *V. cholera* (16 mm). The methanol extract of *E. hirta*

showed the antibacterial against *S. aureus* (22 mm), *E. coil* (20 mm), *P. aeruginosa* (13 mm), *P. mirabilis* (16 mm), *S. typhi* (21 mm), *S. flexneri* (17 mm), *V. cholera* (12 mm) and *S. marcescens* (16 mm). Similarly the aqueous extract antibacterial activity against *E. coil* (23 mm), *P. aeruginosa* (16 mm), *P. mirabilis*(19 mm), *S. typhi* (19 mm), *S. flexneri* (18 mm), *V. cholera* (17 mm)and *S. marcescens*(14 mm). The ethanol extract of *T. erect* exhibited strong antibacterial activity against *S. aureus* (19 mm), *P. mirabilis* (13 mm) and *P. aeruginosa* (13 mm). The methanol extract exhibited strong antibacterial activity against *S. aureus*(18 mm) followed by *P. mirabilis*(16 mm) and *P. aeruginosa* (14 mm,). *L. cephalotes* exhibited good antibacterial activity against *S. aureus*, ethanol (14mm), methanol (12mm) and aqueous (11mm).

MINIMUM INHIBITORY CONCENTRATION AND MINIMUM FUNGICIDAL CONCENTRATION

In our study the MIC ranges from 2 mg/ml to 32 mg/ ml and the MFC ranges from 4 mg/ ml to 32 mg/ml. In case of *A. aspera* the methanol extract showed MIC 2 mg/ml against *S. aureus* and the ethanol extracts (2 mg/ml) against *S. flexneri.* The MIC was observed 8 mg/ ml in ethanol, aqueous extract and 2mg/ ml in methanol extracts against *S. aureus*. In case *V. cholera* 4 mg/ ml MIC was observed in aqueous extracts and 8mg/ ml in ethanol and methanol extracts. In *S. flexneri* 2 mg/ ml MIC was shown by ethanol extract and 4 mg/ ml by ethanol and aqueous extracts. The minimum MIC was exhibited by methanol extracts (8 mg/ml) against *S. aureus*. In case of *A. tunifolus* the minimum MIC was observed in case of methanol extract against *S. aureus.* The ethanol extract of *C. fistula* showed minimum MIC (2 mg /ml) against *V. cholera*. In case of *C. indica* the minimum MIC (4 mg/ml) was found in case of methanol extract against *P. aeruginosa* and the ethanol extract of *C. reflexa* showed minimum MIC (2mg/ ml) against *S. aureus*. The methanol extract (8mg/ml) of *C. sativa* and the aqueous extracts (4mg/ml) of *E. hirta* exhibited minimum MIC against *S. typhi*. The ethanol, aqueous extract of *E. prostrate* exhibited minimum MIC (2mg/ ml) against *S. flexneri*. In case of *H. integrifolia* the minimum MIC (2mg/ ml) was observed against *S. flexneri*. In case of *L. cephalotus* the MIC was observed ranged between 4 mg/ml to 16 mg/ ml and *P. niruri* MIC ranged from 2 mg/ ml to 18 mg/ml. The MIC was found ranged from 4 mg/ ml to 16

mg/ml in *T. erecta*, 16 mg/ ml to 32 mg/ml of *T. procumbens*. The MIC ranged from 2 mg/ml to 32 mg/ ml) in case of *S. nigrum* and 2 mg/ ml to 16 mg/ ml in case of *S. xanthocarpum*.

PRELIMINARY PHYTOCHEMICAL ESTIMATION

Phytochemicals isolated from *A. tenuifolius* were anthraquinones and anthocyanins. Phytochemicals isolated from *A. aspera* were alkaloids, amino acids, flavonoids, saponins, tannins and, phenols. Phytochemicals isolated from *C. fistula* were alkaloids, tannins, flavanoides, amino acids, phenols, anthraquinones and anthocyanins respectively and from *C. indica* phytochemicals were alkaloids, tannins, anthraquinones and anthocyanins. Phytochemicals isolated from *C. reflexa* were alkaloids, saponins, tannins, flavonoids, amino acids, sterols and phenols. Phytochemicals isolated from *C. sativa* was only cardiac glycoside. The phytochemicals isolated from *E. hirta* were tannins and anthocyanins. Phytochemicals isolated from *E. prostrate* were alkaloids, tannins, phenols and anthocyanins. The *H. integrifolia* was having alkaloids, flavonoids, phenols and sterol. *H. zeylanicum* showed presence of tannins, flavonoids, amino acids, phenols and *L. cephalotes* was having tannins, amino acids, phenols and anthraquinones. The phytochemicals isolated from *P. niruri* were saponins, tannins, flavonoids, phenols and anthraquinones. *T. erecta* was found to be contained alkaloids, tannins, flavonoids, amino acids, sterols and anthraquinones, cardiac glycosides and anthocyanins. *S. nigrum* contained saponins and sterols only but *S. xanthocarpum* was having alkaloids, tannins, flavonoids, amino acids, phenols and anthraquinones. The phytochemicals found in *P. minima* were alkaloids, flavonoids, amino acids and anthraquinones.

So the antibacterial activity of studied plants namely; *A. aspera*, *A. tunifolius*, *C. fistula, C. indica*, *C. reflexa*, *C. sativa, E. hirta, T. erect* and*, L. cehalotes* may be due to presence of various isolated phytochemicals which are known to be synthesized by plants in response to microbial infection

CONCLUSION

The results of the present study are encouraging as three out of eighteen plants tested possessed antibacterial properties against most of the tested bacteria. Only three plants extract viz *S. nigrum*, *C. reflexa* and *C. fistula* exhibited antifungal activity against *C. albicans* while two plants extract reveled anifungal activity against fungus *A. niger*. Petroleum ether extracts of mostly plants did not show the antimicrobial activity. Four bacterial species (*S. aureaus*, *P. aeruginosa*, *S. flexneri***,** *V. cholerae*) are susceptible to ethanolic, methanolic and aqueous plants extracts. No single plant was found to be equally effective against all the bacteria tested. The % activity of ethanolic extract of *A. tunifolius* was highest (63.63%). Methanolic extract % activity was 72.72% for *E. hirta* while aqueous extract was 63.63 % of *E. hirta*. Six of the plants tested here (*A. aspera,* A. *tunifolius*, *C. fistula*, *C. sativa*, *E. hirta*, *P. niruri*) exhibited antibacterial activity against more than three bacteria. All these plants have been in use for many years as decoctions or infusions prepared in water to treat various ailments. This work thus provides a scientific basis for the use of these aqueous plant extracts in home-made remedies and their possible application against microorganisms such as *Staph. aureus* and *Ps. aeruginosa,* etc., that cause nosocomial infections. Further studies may lead to their use as safe alternatives.

Table 58: The antimicrobial activity (minimum zone of inhibition in mm) of different medicinal plants

Plant species	Fractions extract	*S. a*	*E.c*	*K. p.*	*P. a.*	*P. m.*	*S.t.*	*S. f.*	*V.c*	*S.m*	*C.a*	*A.n*
A. aspera	Ethanol	16±0.2	0	0	0	0	0	14±0.3	14±0.2	0	0	0
	Methanol	14±0.3	0	0	0	0	0	14±0.2	15±0.4	0	0	0
	Aqueous	14±0.4	0	0	0	0	0	16±0.4	0	0	0	0
	Control	25±0.1	30±0.2	22±0.1	25±0.3	27±0.2	28±0.4	28± 0.2	25±0.3	28±0.1	28±0.2	25±0.3
A. tunifolius	Ethanol	13±0.2	0	0	13±0.2	14±0.2	14±0.3	14±0.2	16±0.1	11±0.1	0	0
	Methanol	14±0.3	0	0	15±0.2	16±0.1	15±0.3	13±0.1	18±0.3	12±0.3	0	0
	Aqueous	12±0.1	0	0	14±0.1	16±0.3	15±0.1	12±0.4	14±0.2	0	0	0
	Control	30±0.1	32±0.1	24±0.2	27±0.1	23±0.2	25±0.3	28±0.2	22±0.1	28±0.4	28±0.3	25±0.2
C. fistula	Pet. Ether	0	0	0	0	0	0	0	0	0	24±0.4	0
	Ethanol	0	0	0	0	0	16±0.4	0	16±0.5	0	22±0.4	0
	Methanol	0	0	0	0	0	14±0.3	0	0	0	0	0
	Aqueous	16±0.1	0	0	0	0	16±0.4	0	13±0.2	0	0	0
	Control	34±0.3	32±0.2	24±0.3	27±0.1	28±0.4	28±0.3	30±0.2	25±0.3	28±0.1	28±0.1	25±0.3
C. sativa	Ethanol	11±0.1	0	18±0.2	0	0	0	18±0.3	16±0.2	0	0	0
	Methanol	14±0.3	0	16±0.1	0	0	0	16±0.1	14±0.1	16±0.0	0	0
	Aqueous	15±0.4	0	15±0.1	0	0	0	16±0.3	14±0.2	16±0.0	0	12±0.3
	Control	33±0.1	30±0.2	24±0.3	28±0.1	26±0.3	25±0.2	28±0.1	25±0.4	28±0.3	28±0.2	25±0.3
C. reflexa	Ethanol	15±0.3	0	0	0	0	0	0	0	0	16±0.2	0
	Methanol	0	0	0	0	0	0	0	13±0.4	0	0	0
	Aqueous	14±0.1	0	0	0	0	0	0	16±0.4	0	12±0.2	0
	Control	35±0.23	32±0.4	26±0.2	27±0.4	28±0.3	25±0.1	28±0.3	25±0.3	30±0.1	28±0.4	25±0.2
C. indica	Ethanol	0	0	0	12±0.1	0	0	0	0	0	0	0
	Methanol	15±43	0	0	14±0.3	13±0.2	0	0	0	0	0	0
	Aqueous	0	0	0	0	15±0.2	0	0	0	0	0	0
	Control	32±0.3	30±0.1	24±0.2	27±0.3	30±0.4	25±0.3	28±0.1	23±0.4	30±0.2	28±0.3	25±0.2

Plant species	**Fractions extract**	***S. a***	***E.c***	***K. p.***	***P. a.***	***P. m.***	***S.t.***	***S. f.***	***V.c***	***S.m***	***C.a***	***A.n***
E. hirta	Methanol	22±0.2	20±0.2	0	13±0.1	16±0.3	21±0.4	17±0.1	12±0.3	16±0.2	0	0
	Aqueous	0	23±0.4	0	16±0.4	19±0.2	19±0.3	18±0.1	17±0.1	14±0.2	0	0
	Control	30±0.3	30±0.2	24±0.1	25±0.2	25±0.1	25±0.1	28±0.3	23±0.20	28±0.4	28±0.3	25±0.2
E. prostrata	Ethanol	0	0	0	0	0	0	14±0.1	0	0	0	0
	Methanol	0	0	0	0	0	0	0	0	0	0	0
	Aqueous	0	0	0	0	0	0	18±0.2	0	0	0	0
	Control	32±0.1	30±0.1	24±0.3	27±0.1	25±0.4	28±0.3	28±0.1	25±0.2	28±0.3	28±0.4	25±0.1
H. integrifolia	Ethanol	0	0	0	0	17±0.5	0	16±0.2	0	0	0	0
	Methanol	0	0	0	0	17±0.3	0	18±0.3	0	0	0	0
	Aqueous	0	0	0	0	14±0.2	0	15±0.4	0	0	0	0
	Control	32±0.3	32±0.4	24±0.2	27±0.3	27±0.4	28±0.2	28±0.1	25±0.2	28±0.4	28±0.2	25±0.4
H. zeylanicum	Ethanol	12±0.3	0	0	0	0	0	0	0	0	0	0
	Methanol	13±0.1	0	0	0	0	0	0	0	0	0	0
	Aqueous	15±0.2	0	0	12±0.3	0	0	0	0	0	0	0
	Control	34±0.3	32±0.1	24±0.4	25±0.3	28±0.1	25±0.2	28±0.3	25±0.4	28±0.3	28±0.2	25±0.1
L . cephalotes	Ethanol	14±0.2	0	0	0	0	0	0	14±0.2	0	0	14±0.2
	Methanol	12±0.1	0	0	0	0	0	0	0	0	0	0
	Aqueous	11±0.2	0	0	12±0.4	0	0	0	0	12±0.3	0	0
	Control	32±0.2	30±0.1	24±0.2	27±22	28±0.1	25±0.2	28±0.1	25±0.3	28±0.1	28±0.1	25±0.2
P. minima	Ethanol	0	0	0	16±0.1	0	0	0	0	0	0	0
	Methanol	0	0	0	13±0.3	0	0	0	0	0	0	0
	Aqueous	0	0	0	11±0.2	0	0	0	0	0	0	0
	Control	32±0.1	30±0.4	26±0.2	25±0.2	28±0.1	25±0.4	28±0.2	0	32±0.1	28±0.3	25±24
P. niruri	Ethanol	16±0.2	0	0	0	0	0	18±0.2	14±0.3	0	0	14±0.3
	Methanol	14±0.4	0	0	0	0	0	19±0.1	17±0.2	0	0	0
	Aqueous	14±0.3	0	0	0	0	0	13±0.4	12±0.2	0	0	0
	Control	34±0.2	32±0.1	24±0.2	27±0.2	30±0.1	28±0.2	28±0.3	25±0.3	28±0.4	28±0.1	25±0.3

Plant species	**Fractions extract**	***S. a***	***E.c***	***K. p.***	***P. a.***	***P. m.***	***S.t.***	***S. f.***	***V.c***	***S.m***	***C.a***	***A.n***
S. nigrum	Methanol	14±0.2	0	0	0	0	0	0	0	0	18±0.2	0
	Aqueous	12±0.3	0	0	0	0	0	0	0	0	14±0.2	0
	Control	32±0.3	30±0.2	24±0.1	27±0.3	25±0.2	28±0.2	28±0.1	25±0.2	30±0.2	28±0.4	25±0.2
S. xanthocarpum	Ethanol	14±0.1	0	0	16±0.2	0	0	0	0	0	0	0
	Methanol	0	0	0	14±0.3	0	0	0	0	0	0	16±0.4
	Aqueous	12±0.2	0	0	14±0.2	0	0	0	0	0	0	0
	Control	30±0.1	30±0.3	24±0.2	27±0.1	28±0.3	25±0.4	28±0.2	22±0.1	28±0.2	28±0.2	25±0.1
T. erecta	Ethanol	19±0.1	0	0	12±0.2	13±0.2	0	0	0	0	0	0
	Methanol	18±0.3	0	0	14±0.1	16±0.3	0	0	0	0	0	0
	Aqueous	10±0.3	0	0	0	11±0.2	0	14±0.2	0	0	0	0
	Control	32±0.2	30±0.3	22±0.2	27±0.1	22±0.3	25±0.2	30±0.3	23±0.4	28±0.1	28±0.3	25±0.2
T. procumbens	Aqueous	14±0.4	0	12±0.2	0	0	0	0	0	12±0.3	0	0
	Control	34±0.4	30±32	24±23	27±16	25±0.2	25±0.3	28±0.2	23±0.1	28±0.4	28±0.2	25±0.4

S.a = *Staphylococcus aureus,* E.c = *Escherichia coli*, K.p = *Klebsiella pneumoniae,* P.a = *Pseudomonas aeruginosa*

P.m = *Proteus mirabilis*, S.t = *Salmonella typhi,* S.f =*Shigella flexneri,* V.c =*Vibrio cholera,* S. m =*Serratia marcescens*

C.a =*Candida albicans*, A.n =*Aspergillus niger*.

Table 59: The minimum inhibitory concentration and minimum fungicidal concentration (mg/ml) of different medicinal plants against microbes.

Plant species	Fractions extract	*S. a*	*E.c*	*K. p.*	*P. a.*	*P. m.*	*S.t.*	*S. f.*	*V.c*	*S.m*	*C.a*	*A.n*
A. aspera	Ethanol	8	0	0	0	0	0	2	8	0	0	0
	Methanol	2	0	0	0	0	0	4	4	0	0	0
	Aqueous	8	0	0	0	0	0	4	0	0	0	0
A. tunifolius	Ethanol	16	0	0	16	32	32	32	16	32	0	0
	Methanol	8	0	0	16	16	16	16	16	16	0	0
	Aqueous	32	0	0	16	16	32	32	32	0	0	0
Cassia fistula	Pet. Ether	0	0	0	0	0	0	0	0	0	16	0
	Ethaonl	0	0	0	0	0	16	0	2	0	8	0
	Methanol	0	0	0	0	0	8	0	0	0	0	0
	Aqueous	4	0	0	0	0	8	0	8	0	0	0
C. indica	Ethaonl	0	0	0	16	0	0	0	0	0	0	0
	Methanol	32	0	0	4	8	0	0	0	0	0	0
	Aqueous	0	0	0	0	8	0	0	0	0	0	0
C. reflexa	Ethaonl	2	0	0	0	0	0	0	0	0	8	0
	Methanol	0	0	0	0	0	0	0	32	0	0	0
	Aqueous	8	0	0	0	0	0	0	8	0	4	0
C. sativa	Methanol	16	16	0	16	32	8	16	16	16	0	0
	Aqueous	0	16	0	16	32	32	4	16	8	0	0
E. hirta	Methanol	16	16	0	16	32	8	16	16	0	0	0
	Aqueous	0	16	0	16	32	32	4	8	0	0	0
E. prostrata	Ethanol	0	0	0	0	0	0	2	0	0	0	0
	Aqueous	0	0	0	0	0	0	2	0	0	0	0
H. integrifolia	Ethaonl	0	0	0	0	16	0	2	0	0	0	0
	Methanol	0	0	0	0	32	0	32	0	0	0	0
	Aqueous	0	0	0	0	16	0	16	0	0	0	0

Plant species	**Fractions extract**	***S. a***	***E.c***	***K. p.***	***P. a.***	***P. m.***	***S.t.***	***S. f.***	***V.c***	***S.m***	***C.a***	***A.n***
H. zeylanicum	Ethanol	32	0	0	0	0	0	0	0	0	0	0
	Methanol	32	0	0	0	0	0	0	0	0	0	0
	Aqueous	16	0	0	16	0	0	0	0	0	0	0
L. cephalotes	Ethanol	4	0	0	0	0	0	0	4	0	0	16
	Methanol	4	0	0	0	0	0	0	0	0	0	0
	Aqueous	8	0	0	16	0	0	0	0	4	0	0
P. minima	Ethanol	0	0	0	8	0	0	0	0	0	0	0
	Methanol	0	0	0	2	0	0	0	0	0	0	0
	Aqueous	0	0	0	32	0	0	0	0	0	0	0
P. niruri	Ethanol	2	0	0	0	0	0	16	2	0	0	18
	Methanol	2	0	0	0	0	0	2	2	0	0	0
	Aqueous	16	0	0	0	0	0	16	16	0	0	0
S. nigrum	Methanol	8	0	0	0	0	0	0	0	0	32	0
	Aqueous	2	0	0	0	0	0	0	0	0	4	0
S. xanthocarpum	Ethanol	16	0	0	8	0	0	0	0	0	0	0
	Methanol	0	0	0	8	0	0	0	0	0	0	0
	Aqueous	4	0	0	2	0	0	0	0	0	0	0
T. erecta	Ethanol	4	0	0	8	8	0	0	0	0	0	0
	Methanol	4	0	0	8	8	0	0	0	0	0	0
	Aqueous	4	0	0	0	16	0	16	0	0	0	0
T. procumbens	Aqueous	16	0	32	0	0	0	0	0	32	0	0

S.a = *Staphylococcus aureus,* E.c = *Escherichia coli*, K.p = *Klebsiella pneumoniae,* P.a = *Pseudomonas aeruginosa*

P.m = *Proteus mirabilis*, S.t = *Salmonella typhi,* S.f =*Shigella flexneri,* V.c =*Vibrio cholera,* S. m =*Serratia marcescens*

C.a =*Candida albicans*, A.n =*Aspergillus niger*.