4. DISCUSSION

An ancient system of medical treatment is based on the rich experiences of innumerable Vaidyas over thousands of years having trials on hundreds and thousands of human being to its credit. This is one possible reason why this system has survived the critics through the ages and is still catering to the health needs of millions all over the world. The survey of medicinal plants of Malvaceae, Sapotaceae and Lythraceae made at rural areas of Marathwasa region, Maharashtra state, India exemplified three important medicinal plants in different habitats. It is noticed that Adansonia digitata L., Mimusops elengi L. and Woodfordia fruticosa L. (Kruz) are the leading species used as remedies against a variety of health problems. The study highlighted that Adansonia digitata was found to be a significant plant species used for the treatment of various ailments such as cough, asthma, bronchitis, dysentery, diarrhea, wounds, ulcer, haemorrhoids, retention of urine, snake bite and fever besides served as antidote for poison.

The feedback from informants taken during the interviews revealed that the plants of Malvaceae, Sapotaceae and Lythraceae are used for many common health problems viz., diabetes, diarrhea, ulcers, jaundice, asthma, arthritis, cough and digestive disorders. Moreover, seven plant species were used by rural people for the treatment of ulcer and diabetes problems. Traditional healers used stem of Caralluma umbellata and Ceropegia juncea, whole plant of Cynanchum acutum, Oxystelma esculentum and Sarcostemma acidum, latex of Cynanchum calliatum and root of Hemidesmus indicus to cure ulcer. Similarly, adult parts viz., stem (Caralluma adscondens and Caralluma adscondens var. attenuata), leaf (Gymnema lactiferum, Gymnema sylvestre and Pergularia brunoniana), root (Marsdenia tenacissima) and root and flowers (Wattakaka volubilis) were used to treat diabetes.

It was also observed that leaves of Gymnema sylvestre and Oxystelma esculentum (jaundice), tubers of Ceropegia bulbosa (urinary bladder stone and fertility problems) and leaves of Gymnema sylvestre (piles and asthma), Ceropegia candelabrum, Sarcostemma viminale and Pentotropis capensis (digestive disorders),
Sarcostemma acidum (rheumatism and arthritis), Oxystelma esculentum (sore throat), Pergularia daemia (stomach ache) and Secamone emetica (nervous disorders) were also found beneficial for the preparation of traditional medicines by the village people. Plant species such as Wattakaka volubilis, Tylophora indica, Sarcostema intermedium and Sarcostema acidum were served as antidote for snake bite. Plants viz., Calotropis procera, Gymnema elegans and Gymnema sylvestre were used for eye problems while Pentotropis capensis was administered as nasal drops for cold related problems.

During earlier ethnobotanical studies considerable number of species of Malvaceae, Sapotaceae and Lythraceae were reported to be occurred and useful as folk medicines in Semmalai reserve forest (Ganesan et al., 2006), Kanchipuram District (Muthu et al., 2006), Palani hills of Dindigul district (Ignacimuthu et al., 2006), Sirumalai hills of Dindigul district (Karuppusamy, 2007), Vellore District (Thirumalai et al., 2009), Villupuram District (Sankaranaryanan et al., 2010), Agasthiyamalai region of Tirunelveli district (Subhshini and Uma sankari, 2010), Javadhu hills in Thiruvannamalai district (David and Sudarsanam, 2011), Dharmapuri district (Alagesapoopathi, 2011) and Yelagiri hills of Eastern Ghats of Salem district (Senthilkumar et al., 2014).

It is evident that in most of the districts of Marathwada the species of Malvaceae, Sapotaceae and Lythraceae are found common but the vernacular name and the communities and or tribes involved in traditional health care practices were reported to be different with respect to their local language and dwelling locations. The traditional uses of species of Malvaceae, Sapotaceae and Lythraceae by local people and tribes were also recorded in Seshachalam hill ranges in Cadappa district (Reddy et al., 2009), Medak District (Reddy et al., 2010), Rapur forest of Nellore district of Andra Pradesh (Neelima et al., 2011) and Rayalaseema region (Anjaneyulu and Sudarsanam et al., 2013) of Andra Pradesh and in Kodagu district (Lingaraju et al., 2013) and Biligiri Rangana hills of Chamarajanagar district of (Gireesha and Raju, 2013) Karnataka.
It was also reported that plant species viz., *Calotropis* sp., *Gymnema* sp., *Hemidsemus* sp., *Ceropegia* sp., and *Tylophora* sp., were found to be more beneficial medicinal plants in Arunachala Pradesh (Kala, 2006). North Sikkim (Pradhan and Badola, 2006); in Rajasthan (Choudry et al., 2008); Himalaya (Muneshkumar et al., 2011); Haryana (Panghal et al., 2010); Maharashtra (Kamble et al., 2010); Uttar Pradesh (Singh et al., 2012); North East India (Majumdar and Datta, 2013); Gujarat and Punjab (Parvaiz et al., 2013) and in Madhya Pradesh (Gwalwanshi et al., 2014).

The plant species such as *Pergularia dameia*, *Calotropis procera*, *Secomone acidum*, *Lepdatania hastata*, *Sarcostemma viminale* and *Gargronema napalenese* were also found and made useful for human health problems in many African countries and in countries like Pakistan, Malaysia and Bangladesh (Kayode, 2006; Teklehaymanot and Giday, 2007; Nanyiingi et al., 2008; Mesfin et al., 2009; Lawal et al., 2010; Samuel et al., 2010; Abuzid and Mohamad, 2011; Soejarto et al., 2012; Belayneh et al., 2012; Singh et al., 2012; Ahmed et al., 2013 and Nahar et al., 2014). Comparatively, the attempts made in Northern states of India and in abroad indicate that only limited number of Malvaceae, Sapotaceae and Lythraceae members was employed for local health care practices.

Further, it has been confirmed that the Southern parts of India enriched with large number of plant species and their utility in rural areas is also better than other parts of India and in abroad. It may be attributed due to geographical and or prevailing climatic conditions and other associated factors that limit the species distribution. The respondents of our study informed that remedial preparations were made from different parts of the plants such as whole plant, leaves, stem, bark, fruits, seed, latex, bulb, tuber, rhizome and flowers. It is obvious that each and every part of plants was used for the medication either singly or in combination with other plants. Moreover, the parts preferred found to be varied with respect to type of species available and curative values for different ailments.

Among the plant parts used, leaf (34%) was the most commonly useful part to treat various ailments followed by whole plant (27%), root (20%), stem (10%),
latex (4%), tuber (3%) and seeds (2%). The common use of leaf was reported due to easy availability of this plant part in the study area. In addition, different plant parts from a single species were prepared in different methods and used to treat various types of ailments. The data collected from local communities also revealed that the rural people employ several methods of preparation of plant materials for medicinal use and or to treat different ailments. The most common methods of drug preparation were extract (44%), juice (30%) powder (25%), decoction and paste (18%) and latex (2%).

It was reported from traditional healers that different liquids such as salt, water, juices, honey, mustard oil, milk, and pepper powder and wheat flour were traditionally employed as vehicles for the preparation of the remedies. Milk was found to be an effective vehicle for preparing folk medicines. In all herbal preparations water was used as one of the dilatants to optimizes required dose of remedies while administration by rural people for various health problems. Similarly, the parts used, mode of preparation and method of applications are almost in agreement with observations made in the above mentioned previous investigations in respective locations in Tamil Nadu and in other states. However, in some reports, it has been reported the useful parts, preparation methods and mode of application for health care (one or two ailments) are different because these practices are being followed by the local healers for several decades.

It could be concluded from the reports that specific people communities, from the region have traditional knowledge, customs, practices, health problems and availability of curative plant species of Malvaceae, Sapotaceae and Lythraceae. During our it was also evidenced that the predominant ethnic tribal communities involving in the traditional herbal practices are carried out in some parts of Nanded, Parbhani, Jalna, Aurangabad, Beed, Latur and Osmanabad districts around Marathwada and their distribution was varying in the studied rural areas of Marathwada. It was observed that these communities found to have the knowledge of folklore medicines to treat various ailments in the rural areas. However, as reported by informants the number of male between the age group of 50-60 was in practice of traditional medicines but with less frequency (43.75%).
From the collected information it is stated that the vernacular name, useful part and mode of preparation and administration were mostly common but varying from community to community distributed in different rural areas of Marathwada. The data indicated that the study area has plenty of medicinal plants in the plain regions of rural areas to treat a wide spectrum of human ailments. It is evident from the interviews conducted in different villages that the knowledge of medicinal plants is limited to traditional healers, herbalists and elderly persons who belong to various communities living in rural areas. The elderly people of study area have a strong belief in the efficacy and success of plant based therapies.

The knowledge of traditional medicines is lacking among the younger generation due to their tendency to migrate to cities for remunerative jobs. Moreover, the factors viz., changing life style, migration of rural people, urbanization, income generative activities, new employment schemes, deforestation and over exploitation of medicinal plants in remote villages would also have significant retrogressive impact on it. It may be concluded that there is a possibility of losing this wealth of knowledge in the rural areas in the near future. In general, the study focused that there is enormous scope for traditional medicines from species of Malvaceae, Sapotaceae and Lythraceae in the villages of many parts of Maharashtra and other states of India as the rural communities collect the curative plant resources in and around their dwelling areas and also from adjoining hill regions.

Thus, the documentation of traditional system of medicines practiced by non tribal communities in other regions of our country is necessary to harness the fruits of medicinally valuable plants and to adopt suitable conservation programme for sustainable utilization. Moreover, scientific validation of many species of Malvaceae, Sapotaceae and Lythraceae in terms of characterization of bioactive principles and formulation of herbal drugs are yet to be explored to use their bio-efficiency in treating various ailments and or in modern health care practices.

Extraction (as the term is pharmaceutically used) is the separation of medicinally active portions of plant (and animal) tissues using selective solvents through standard procedures. The purpose of standardized extraction procedures for
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crude drugs (medicinal plant parts) is to attain the therapeutically desired portions and to eliminate unwanted material by treatment with a selective solvent known as menstrum. The extract thus obtained, after standardization, may be used as medicinal agent as such in the form of tinctures or fluid extracts or further processed to be incorporated in any dosage form such as tablets and capsules. These products contain complex mixture of many medicinal plant metabolites, such as alkaloids, glycosides, terpenoids, flavonoids and lignans (Handa, 2008).

Successful determination of biologically active compounds from plant material is largely dependent on the type of solvent used in the extraction procedure. In the present study the soxhlet extraction methods was used. Non standardized procedures of extraction may lead to the degradation of phytochemicals present in the plants and may lead to the variations thus leading to the lack of reproducibility. (Prashant Tiwari, et al 2011). The solvents used for preparation of crude extracts from various adult parts of medicinally valuable plants exhibited maximum extractive value in methanol while using aerial parts of Ceropedia juncea and leaf of Pentatropis capensis and Wattakaka volubilis. But petroleum ether and water had high extractive value for leaf of Gymnema sylvestre and whole plant of Oxystelma esculentum.

However in both these plants the extractive value was very close while using methanol. The least extractive value was recorded for ethyl acetate extracts of Ceropedia juncea and Wattakaka volubilis, water extracts of Gymnema sylvestre and Pentatropis capensis and petroleum ether extract of Oxystelma esculentum. In earlier studies, the high extractive value of methanol for woody stem extract of Wrightia tinctoria (Pritam and Sanjay, 2011) and ethanol for whole plant extract of Cardiospermum halicacabum (Viji and Murugesan, 2010) was reported. However, maximum extractive value was found in water and alcoholic extracts of whole plant of Oxystelma esculentum (Poornima et al., 2009) and leaf of Cardiospermum canescens (Pratap et al., 2012). In recent times, many medicinal plants have been used as alternative medicine for treatments or preventions of a number of diseases, including diabetes, hyperlipidemia, cancer and Alzheimer’s diseases.
Medicinal plants are become very popular because they have very few side effects as compared to synthetic drugs (Shruthi et al., 2012). The curative properties of medicinal plants are conceivably due to the presence of a variety of secondary metabolites such as alkaloids, flavonoids, glycosides, saponins, tannins, phenolic compounds and steroids etc. They are not indispensable for the plant that contains them; their production is secondary to plant hence the name secondary metabolites. Accordingly, the World Health Organization (WHO) consultative group on medicinal plants has formulated a definition of medicinal plants in the following way: “A medicinal plant is any plant, in which one or more of its organ, contains substance that can be used for therapeutic purpose or which is a precursor for synthesis of useful drugs” (Goldstein, 1974).

The preliminary phytochemical screening of the plants or plant parts might be helpful in extraction of active principles and sometimes may lead to the discovery and development of new compounds. The phytochemical analysis conducted on *S. colebrookiana* and *S. violacea* revealed the presence of flavonoids, alkaloids, polyphenolics, phytosterols and proteins. Quantitative phytochemical analysis indicated that the chloroform extract of *S. colebrookiana* and *S. violacea* contain significant amounts of phenolics and flavonoids. Phenolics and flavonoids are ubiquitously seen in most of the plant species and reported to possess a broad spectrum of biological properties (Nijveldt et al., 2001). *Scutellaria baicalensis* is one of the most famous herb comes under *Scutellaria* genus and widely used for treating a number of ailments in Traditional Chinese Medicine (TCM).

The active ingredients of *S. baicalensis* are reported as flavonoids such as baicalein, baicalin, wogonin and wogonoside. Among these flavonoids, baicalein is the most active one and reported to have various beneficial effects such as anti-oxidant, anti-inflammatory, anti-cancer, hepatoprotective, antimutagenic etc. Being members of *Scutellaria* genus, *S. colebrookiana* and *S. violacea* might contain the above flavonoids. To detect the presence of most active flavonoid baicalein, run spectrophotometric and HPLC analysis of chloroform extract of *S. colebrookiana* and *S. violacea* along with baicalein. Interestingly, spectrophotometric analysis
between 200 and 900 nm range showed compound with absorption maxima at 210, 276, and 360 λ which was closely similar to standard baicalein.

No other visible peaks were observed in the spectra which indicate that a simple soxhlet extraction itself yields baicalein with fewer impurities. HPLC method facilitates qualitative and quantitative analysis of baicalein in *S. colebrookiana* and *S. violacea*. Peaks obtained for extracts showed identical retention time to that of baicalein and confirmed its presence in *S. colebrookiana* and *S. violacea*. To estimate quantity of baicalein, prepared calibration curve of baicalein and from that curve, quantity of baicalein present in root extract of both plants could detect. HPTLC finger printing profile is valuable as a phytochemical marker and also a good estimation of genetic variability in plant populations.

It is also an economical method for separation, qualitative identification, or semi-quantitative analysis of samples and can be used to solve many qualitative and quantitative analytical problems in a wide range of fields, including medicine, pharmaceuticals, chemistry, biochemistry, food analysis, toxicology and environmental analysis (Jain *et al.*, 2009). In the present investigation, the preliminary phytochemical screening of seed extracts of *Adansonia digitata* revealed that flavones, cardiac glycosides, phenolic compounds, carbohydrates and proteins were found in all crude extracts, while carbohydrates was absent in methanol extracts. The table 1 shows the results of qualitative phytochemical screening; in the figure 14, seed extracts of *Adansonia digitata* show phytochemicals in the order of alkaloids> steroids> flavonoids> phenolic compounds> saponins> tannins.

The selection of crude seed extracts of *Adansonia digitata* for quantitative phytochemical determination was depends on the presence of highest concentration of alkaloids, terpenoids and saponins concentration. The results of preliminary qualitative analysis show highest concentration of same in methanol, acetone and chloroform seed extracts of *Adansonia digitata*, shown in figure 1, 2 and 3 respectively. The quantitative determination of phytochemical show, methanolic seed extracts of *Adansonia digitata* as given in table 2 indicates that the...
alkaloid content is highest as 81.56±0.56 mg/g and the tannin contents is lowest as 10.01±0.12 mg/g. Acetone seed extracts of *Adansonia digitata* show steroid is highest as 77.9±8.2 mg/g and the saponins is lowest as 9.45±2.7 mg/g.

The chloroform extracts of seed of *Adansonia digitata* show alkaloids is highest as 84.65±2.19 mg/g and tannins is lowest as 7.12±0.28 mg/g. all values were positively significant at (P<0.05) 5% level. Secondary metabolite of crude seed extracts of *Adansonia digitata* is range between 84.65±2.19 (alkaloids) to 7.12±0.28 (tannins) mg/g. The preliminary phytochemical screening of endosperm extracts of *Adansonia digitata* revealed that alkaloids, flavones, reducing sugar, carbohydrates, cardiac glycosides, phenolic compounds and proteins were found in all crude extracts, while flavonoids and terpenoids were absent in all crude extracts. The table 2 shows the results of qualitative phytochemical screening; in the figure 14, crude endosperm extracts of *Adansonia digitata* show phytochemicals in the order of alkaloids> flavonoids> steroids> saponins> phenolic compounds> tannins.

The selection of crude endosperm extracts of *Adansonia digitata* for quantitative phytochemical determination was based on the presence of highest concentration of alkaloids, tannins and saponins concentration. The results of preliminary qualitative analysis show highest concentration of same in methanol, acetone and chloroform endosperm extracts of *Adansonia digitata*, shown in figure 1, 2 and 3 respectively. The quantitative determination of phytochemicals are enlisted in table 2 from methanolic endosperm extracts of *Adansonia digitata* indicates highest steroid content i.e. 75.1±0.48 mg/g and lowest phenolic compounds contents i.e. 10.9±15.5 mg/g. Acetone extracts of endosperm of *Adansonia digitata* shows presence of flavonoids which are highest i.e. 51.58±10.6 mg/g and the saponins lowest i.e. 2.93±0.05 mg/g.

The chloroform extracts of endosperm of *Adansonia digitata* show presence of alkaloids which is highest value i.e. 84.53±2.19 mg/g and tannins is lowest as 5.5±0.48 mg/g. all values were positively significant at (P<0.05) 5% level. Secondary metabolite of crude endosperm extracts of *Adansonia digitata* is range between 84.53±2.19 (alkaloids) to 2.93±0.05 mg/g. The preliminary phytochemical
screening of leaf extracts of *Mimusops elengi* revealed that steroids, flavonoids, cathaholic, cardiac glycosides, phenolic compounds, carbohydrates and proteins were found in all crude extracts, while alkaloids was absent in acetone and hexane crude extracts. The table 1 shows the results of qualitative phytochemical screening; in the figure 14, leaf extracts of *Mimusops elengi* show phytochemicals in the order of alkaloids> saponins> flavonoids> tannins> phenolic compounds> steroids.

The quantitative phytochemical determination of crude leaf extracts of *Mimusops elengi* was tested and shown presence of highest concentration of alkaloids, terpenoids and saponins concentration. The results of preliminary qualitative analysis show highest concentration of same in methanol, acetone and chloroform leaf extracts of *Mimusops elengi*, shown in figure 1, 2 and 3 respectively. The quantitative determination of phytochemical show, methanolic leaf extracts of *Mimusops elengi* as given in table 2 indicates that the alkaloids content is highest as $45.1 \pm 1.2$ mg/g and the saponins contents is lowest as $0.589 \pm 0.07$ mg/g. Acetone leaf extracts of *Mimusops elengi* show alkaloid is highest as $54.2 \pm 2.9$ mg/g and the steroids is lowest as $2.0 \pm 0.31$ mg/g.

The chloroform leaf extracts of *Mimusops elengi* shows saponin content which is highest i.e. $33.1 \pm 2.8$ mg/g and alkaloids is lowest i.e. $0.486 \pm 0.01$ mg/g, all values were positively significant at (P<0.05) 5% level. Secondary metabolite of crude leaf extracts of *Mimusops elengi* is range between $54.53 \pm 2.9$ (alkaloids) to $0.486 \pm 0.01$ mg/g. The preliminary phytochemical screening of leaf extracts of *Woodfordia fruticosa* revealed that alkaloids, steroids, terpenoids, flavonoids, cardiac glycosides, reducing sugar, phenolic compounds, carbohydrates and proteins were found in all crude extracts, while flavones was absent in acetone, chloroform and hexane crude extracts. The table 1 shows the results of qualitative phytochemical screening; in the figure 14, leaf extracts of *Woodfordia fruticosa* show phytochemicals in the order of flavonoids> saponins> steroids> alkaloids> tannins> phenolic compounds.

The phytochemical determination of secondary metabolites from crude leaf extracts of *Woodfordia fruticosa* depends upon the presence of highest
concentration of alkaloids, terpenoids and saponins concentration. The results of preliminary qualitative analysis show highest concentration of metabolites which are shown in figure 1, 2 and 3 respectively. The quantitative determination of phytochemicals indicates that the saponins content is highest i.e. 54.82±7.3 mg/g and the phenolic compounds contents is lowest i.e. 11.12±13.9 mg/g. Acetone leaf extracts of Woodfordia fruticosa show flavonoid is highest i.e. 63.01±0.01 mg/g and the alkaloids is lowest i.e. 5.31±0.04 mg/g.

The chloroform leaf extracts of Woodfordia fruticosa show presence of alkaloids which is highest i.e. 90.2±12.4 mg/g and steroids is lowest i.e. 1.8±0.02 mg/g. all values were positively significant at (P<0.05) 5% level. Secondary metabolite of crude leaf extracts of Woodfordia fruticosa is range between 90.2±12.4 (flavonoids) to 5.31±0.04 (alkaloids) mg/g. The observations on phytochemical screening are in accordance with the findings made in previous studies which reported variation in occurrence of bioactive compounds in different solvent extracts of whole plant of Ceropegia species (Muthukrishnanan et al., 2013) leaf of Gymnema sylvestre (Kalidas and Mohan, 2010), whole plant of Pentatropis capensis (Sarra et al., 2012) and leaf of Wattakaka volubilis (Natarajan and Arul Gnana Dhas, 2013).

Moreover, the earlier attempts on qualitative analysis recorded by the workers shown the presence of alkaloids, triterpenoids, phenolics, flavanoids, tannins and saponins in ethanolic leaf extract of Ceropegia juncea (Sharma Paras et al., 2011); alkaloid, tannin, steroids and flavanoids in chloroform extract of leaf of Gymnema sylvestre (Gajendran et al., 2012); alkaloids, tannins, triterpenoids, glycosides and flavanoids in alcoholic extract of whole plant of Oxystelma esculentum (Poornima et al., 2009); alkaloids, tannins, phenols, glycosides, flavanoids and steroids in methanolic extract of leaf of Pentatropis capensis (Rama Prabha and Vasantha, 2010); alkaloids, phenolic compounds, triterpenoids, steroids, flavanoids and glycosides in ethanolic extract of root of Wattakaka volubilis (Yogita et al., 2013).
These observations were also in conformity with our results. In a recent study it has been reported that few species including *Ceropegia juncea* of families Asclepiadaceae and Apocynaceae found to have coumarin compounds (Karayil et al., 2014). The comparative preliminary phytochemical screening of *Rumex vesicarius* L. was undertaken for the identification of different chemical constituents present in different parts of plant and individual screening of both hot and cold extracts indicated the presence of all major phytoconstituents. Petroleum ether, chloroform, methanol and aqueous extract of *Rumex vesicarius* L. obtained by cold maceration showed the presence of highest amount of phytoconstituents such as phenol, alkaloids, flavonoids, tannins, steroids, terpenoids etc., compared to extract obtained by soxhlet extraction method.

In case of extract obtained by soxhlet extraction method the phenols were detected in trace and alkaloids, tannins glycosides, flavonoids were completely absent in aqueous extract. Whereas the aqueous extract by cold maceration indicated the presence of these above phytoconstituents. However the comparative preliminary phytochemical screening indicated that cold maceration extraction yielded significantly more number of phytoconstituents than hot soxhlet extraction method. Polyphenols are compounds of great interest to researchers worldwide for their varying beneficial effects in various diseases. However variability at different stages of maturation and growing condition such as temperature and extraction condition affect the content of phenol (Zheng, 2001).

Based on the results obtained from preliminary phytochemical screening, the methanol extract of Whole plant and Leaf of both hot and cold extraction is subjected to quantitative estimation of total phenols and flavonoids. The methanol extract of *Rumex vesicarius* L. has shown the presence of good amount of total phenol and Flavonoids. Similar observations were reported by Jimoh et al., (2008). According to them the concentration of Total phenols and Flavonoids is much higher in methanol extract. It is further confirmed by the qualitative separation of phytoconstituents of methanol extract of both hot soxhlet and cold maceration extract on TLC using chloroform: benzene: diethyl ether (3:2:0.5). When
the chromatogram of WPH and WPC of *Rumex vesicarius* L. were compared, some similarities have been observed.

The spots generated with hRF values 0.99, 0.94, 0.89, 0.85, 0.75, 0.69, 0.32, 0.22, 0.21 were found in both hot and cold extract (WPH, WPC). And few spots having hRF values 0.97, 0.65, 0.58 were observed only in WPC. The possible reason may be, in case of hot soxhlet extraction the most volatile parts of the plant may be damaged or lost with exposure to heat (Nikhal et al., 2010). Thus the overall data suggest that the use of the cold maceration method will yield a more accurate assessment of the number of phytoconstituents in plant while either method can be used for the isolation of specific phytoconstituents. And also successful prediction of botanical compounds from plant material is largely dependent on the type of the solvent used and the method of extraction followed (Prashant et al., 2011).

However the *Rumex vesicarius* L. shows the presence of different major bioactive constituents which is in agreement with the work carried out by Humeera et al., (2013). According to them the chemical analysis of different extracts of *Rumex dentatus* showed the presence of various phytoconstituents. In the present study, the methanolic and acetone extracts found to have maximum number of phytoconstituents and followed by chloroform. The extracts prepared with hexane, ethanol and water had least number of compounds but they are biologically potential secondary metabolites. The qualitative studies evidence that methanol might be more potential than other solvents due to its solubility of bioactive compounds (De Boer et al., 2005).

Furthermore, the differential occurrence of phytoconstituents recorded in this study can be rationalized in terms of polarity of the compounds being extracted by each solvent and the ability of the solvents. It was also in accordance with the observations made in previous studies (De Boer et al., 2005 and Taous et al., 2005). The study emphasizes that the solvent methanol might be employed for isolation of phytochemicals from plants. It has been reported that the members of family Malvaceae, Sapotaceae and Lythraceae are well known to Indian
System of Medicine since ancient time as they contain several phytochemicals like alkaloids, sterols, tannins, terpenoids and flavanoids (Nikajoo, 2009).

Similarly, it was observed that alkaloids are very common in all the plant species of Malvaceae, Sapotaceae and Lythraceae. The petroleum ether extract of Gymnema sylvestre and Wattakaka volubilis contained triterpenoids and steroids whereas, triterpenoids alone detected in Oxystelma esculentum and Pentatropis capensis. The phenolic compounds and tannins were found common in chloroform and ethyl acetate extracts of Ceropegia juncea, Gymnema sylvestre and Wattakaka volubilis. Moreover, the methanolic and water extracts of Ceropegia juncea contained saponins and steroids while saponin alone found in Gymnema sylvestre and Wattakaka volubilis.

Therefore, our observations are in line with earlier studies emphasized the presence of similarity in existence of those compounds viz., alkaloids, phenolic compounds, tannins, triterpenoids and steroids besides flavanoids and glycosides. The study evidences that phytochemicals in the members of Asclepiadaceae might have close resemblances and this substantial chemical profiling information can be used in characterization and or authentication of species of Asclepiadaceae along with morphological features documented by (Arumugasamy et al., 2013).

**HTPTLC FINGERPRINTING CHARACTERISTICS**

The HPTLC finger printing characteristic of chloroform extracts of Mimusops elengi L., Adansonia digitata L. and Woodfordia fruticosa L. plants after scanning at 254 nm wavelengths shown in figure-36 & table-15. The chloroform extracts of Mimusops elengi L., Adansonia digitata L. and Woodfordia fruticosa L. plants after scanning at 254 nm found resemblances of \( R_f \) values ranges from (0.05 to 0.95). The densitometric scanning at 254 nm revealed that the chloroform extract
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exhibited highest 9 peaks in *Woodfordia fruticosa* while there was 8 peaks in *Mimusops elengi*; 7 peaks in *Adansonia digitata* seed extracts and last lowest 5 peaks in *Adansonia digitata* endosperm extract. The number of *R*<sub>f</sub> values evidences specific types and number of components in the chloroform extract of selected plants.

The lower number 5 peaks in *Adansonia digitata* endosperm extract revealed that there was less number of components against other plants while using chloroform extract. The data also depict there was similarity in *R*<sub>f</sub> values (0.19) among *Adansonia digitata* seed extract and *Mimusops elengi* leaf extract. Similarity also found in *R*<sub>f</sub> values (0.26) among *Adansonia digitata* seed extract and *Woodfordia fruticosa* leaf extract. The *Adansonia digitata* seed extract showed *R*<sub>f</sub> value of 0.42 in the peak 5. Comparatively, close *R*<sub>f</sub> value 0.48 were also found in peak 5 of *Mimusops elengi* leaf extract.

The chloroform crude extracts of *Mimusops elengi* L., *Adansonia digitata* L. and *Woodfordia fruticosa* L. plants after scanning at 280 nm found resemblances of *R*<sub>f</sub> values ranges from (0.06 to 1.09). The densitometric scanning at 280 nm exhibited more number of peaks than at 254 nm in the chloroform extracts of test plants (figure-36 & table-16). The highest number peaks founds in *Woodfordia fruticosa* leaf extract (15) followed by *Adansonia digitata* seed extract and *Mimusops elengi* leaf extract (11) and *Adansonia digitata* endosperm extract (10). There was similarly in the *R*<sub>f</sub> values in peak 1 (0.06 – 0.07 - 0.06), peak 2 (0.11 – 0.11), peak 7 (0.68 – 0.69) and peak 10 (0.95 – 0.95) while scanning chloroform extract of all the selected plants. The densitometry scanning at 280 nm revealed that the chloroform crude extract exhibited highest 15 peaks in *Mimusops elengi* while there was 11 peaks in *Adansonia digitata* seed extract and *Mimusops elengi* leaf crude extract; 10 peaks found in *Adansonia digitata* endosperm crude extract.

The HPTLC finger printing characteristic of methanol crude extracts of *Mimusops elengi* L., *Adansonia digitata* L. and *Woodfordia fruticosa* L. plants after scanning at 254 nm wavelengths shown in figure-37 & table-17. The methanol crude extracts of *Mimusops elengi* L., *Adansonia digitata* L. and *Woodfordia fruticosa* L.
plants after scanning at 254 nm found resemblances of $R_f$ values ranges from (0.07 to 0.99). The densitometric scanning at 254 nm revealed that the methanol crude extract exhibited highest 12 peaks in *Mimusops elengi* while there was 11 peaks in *Adansonia digitata* seed extract; 9 peaks in *Adansonia digitata* endosperm crude extract and *Woodfordia fruticosa* leaf crude extract respectively. The number of $R_f$ values evidences specific types and number of components in the methanol crude extracts of selected plants.

The lower number 9 peaks in in *Adansonia digitata* endosperm crude extract and *Woodfordia fruticosa* leaf crude extract respectively revealed that there was less number of components against other plants while using methanol crude extract. The data also depict there was similarity in $R_f$ values (0.11) among *Adansonia digitata* seed extract and *Mimusops elengi* leaf extract. Similarity also found in $R_f$ values (0.26) among *Adansonia digitata* seed extract and *Woodfordia fruticosa* leaf extract. And $R_f$ values (0.38-0.39) among *Adansonia digitata* seed extract and *Mimusops elengi* leaf extract. The *Adansonia digitata* seed extract showed $R_f$ value of 0.31 in the peak 5 comparatively, close $R_f$ value 0.35 were also found in peak 5. of *Mimusops elengi* leaf extract. Also, *Adansonia digitata* seed extract showed $R_f$ value of 0.38 in the peak 6 comparatively, close $R_f$ value 0.39 were also found in peak 6 of *Mimusops elengi* leaf extract.

The methanol crude extracts of *Mimusops elengi* L., *Adansonia digitata* L. and *Woodfordia fruticosa* L. plants after scanning at 280 nm found resemblances of $R_f$ values ranges from (0.06 to 1.01). The densitometric scanning at 280 nm exhibited more number of peaks than at 254 nm in the methanol extracts of test plants (figure-37 & table-18). The highest number peaks founds in *Woodfordia fruticosa* leaf extract (16) followed by *Adansonia digitata* seed extract and *Mimusops elengi* leaf extract (11) and *Adansonia digitata* endosperm extract (09). There was similarity in the $R_f$ values in peak 3 (0.14 – 0.14), peak 4 (0.38 – 0.38), peak 7 (0.59 – 0.59), peak 9 (0.75 – 0.75) and peak 11 (0.91 – 0.91) while scanning methanol extract of all the selected plants. The densitometric scanning at 280 nm revealed that the methanol crude extract exhibited highest 16 peaks in *Mimusops elengi* while there
was 11 peaks in *Adansonia digitata* seed extract and *Mimusops elengi* leaf crude extract; 09 peaks found in *Adansonia digitata* endosperm crude extract.

The HPTLC finger printing characteristic of acetone crude extracts of *Mimusops elengi* L., *Adansonia digitata* L. and *Woodfordia fruticosa* L. plants after scanning at 254 nm wavelengths shown in figure-38 & table-19. The acetone crude extracts of *Mimusops elengi* L., *Adansonia digitata* L. and *Woodfordia fruticosa* L. plants after scanning at 254 nm found resemblances of $R_f$ values ranges from (0.08 to 0.80). The densitometric scanning at 254 nm revealed that the acetone crude extract exhibited highest 08 peaks in *Woodfordia fruticosa* while there was 07 peaks in *Mimusops elengi* leaf crude extract; 4 peaks in *Adansonia digitata* seed crude extract; and least i.e. 2 peaks found in *Adansonia digitata* endosperm crude extract. The number of $R_f$ values evidences specific types and number of components in the methanol crude extracts of selected plants.

The lower number 4 peaks in *Adansonia digitata* seed crude extract revealed that there was less number of components against other plants while using methanol crude extract. The data also depict there was similarity in $R_f$ values (0.08) among *Adansonia digitata* seed crude extract and *Adansonia digitata* seed crude extract. Similarity also found in $R_f$ values (0.11) among *Adansonia digitata* endosperm crude extract and *Mimusops elengi* leaf crude extract. And $R_f$ values (0.21 - 0.21) among *Adansonia digitata* seed crude extract and *Mimusops elengi* leaf crude extract. The $R_f$ values also found (0.52 - 0.52) among *Mimusops elengi* leaf crude extract and *Woodfordia fruticosa* leaf crude extract. The *Adansonia digitata* seed extract showed $R_f$ value of 0.15 in the peak 3 comparatively, close $R_f$ value 0.16 were also found in peak 3 of *Mimusops elengi* leaf crude extract.

The acetone crude extracts of *Mimusops elengi* L., *Adansonia digitata* L. and *Woodfordia fruticosa* L. plants after scanning at 280 nm found resemblances of $R_f$ values ranges from (0.06 to 1.09). The densitometry scanning at 280 nm exhibited more number of peaks than at 254 nm in the acetone crude extracts of test plants (figure-38 & table-20). The highest number peaks founds in *Mimusops elengi* leaf crude extract (11) followed by *Woodfordia fruticosa* leaf crude extract (10),
Adansonia digitata endosperm crude extract exhibit 4 peaks and Adansonia digitata seed crude extract (03). There was similarity in the $R_f$ values in peak 2 (0.13 – 0.13), peak 4 (0.24 – 0.24), peak 7 (0.59 – 0.59) while scanning methanol extract of all the selected plants. The densitometry scanning at 280 nm revealed that the acetone crude extract exhibited highest 11 peaks in Mimusops elengi while there was 10 peaks in Woodfordia fruticosa leaf crude extract and 04 peaks found in Adansonia digitata endosperm crude extract.

The HPTLC finger printing characteristic of hexane crude extracts of Mimusops elengi L., Adansonia digitata L. and Woodfordia fruticosa L. plants after scanning at 254 nm wavelengths shown in figure-39 & table-21. The hexane crude extracts of Mimusops elengi L., Adansonia digitata L. and Woodfordia fruticosa L. plants after scanning at 254 nm found resemblances of $R_f$ values ranges from (0.06 to 0.91). The densitometric scanning at 254 nm revealed that the hexane crude extract exhibited highest 7 peaks in Mimusops elengi while there was 4 peaks in Woodfordia fruticosa leaf crude extract; 3 peaks found in Adansonia digitata seed crude extract. The least peak found in Adansonia digitata endosperm crude extract i.e. 1. The number of $R_f$ values evidences less specific types and number of components in the hexane crude extracts of selected plants.

The lower number 1 peak in Adansonia digitata endosperm crude extract and Adansonia digitata seed crude extract respectively revealed that there was less number of components against other plants while using acetone crude extract. The data also depict there was similarity in $R_f$ values (0.19) among Adansonia digitata endosperm crude extract and Woodfordia fruticosa leaf crude extract. Similarity also found in $R_f$ values (0.52 – 0.58) among Mimusops elengi leaf crude extract and Woodfordia fruticosa leaf crude extract. The hexane crude extracts of Mimusops elengi L., Adansonia digitata L. and Woodfordia fruticosa L. plants after scanning at 280 nm found resemblances of $R_f$ values ranges from (0.10 to 0.99). The densitometric scanning at 280 nm exhibited more number of peaks than at 254 nm in the hexane crude extracts of test plants (figure-39 & table-22).
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The highest number peaks founds in Woodfordia fruticosa leaf extract (09) followed by Minusops elengi leaf crude extract (8) and Adansonia digitata endosperm crude extract exhibit least number of peaks (4). There was similarity in the \( R_f \) values in peak 2 (0.13 – 0.13), peak 1 (0.10 – 0.10) while scanning hexane crude extract of all the selected plants. The densitometric scanning at 280 nm revealed that the hexane crude extract exhibited highest 09 peaks in Woodfordia fruticosa leaf crude extract, while there was 8 peaks in Minusops elengi leaf crude extracts.

Here, HPTLC analysis of chloroform acetone and methanol extract of Adansonia digitata, Woodfordia fruticosa and Minusops elengi conducted to figure out active ingredients present in extracts. And it contains not a single compound but a mixture of compounds and so it is established that the pharmacological activity shown by them are due to the cumulative effect of all the compounds in composite. HPTLC analysis further confirms the presence of baicalein in chloroform extract of these two plants. Previous studies detected the pharmacological properties of S. colebrookiana and S. violacea including anti-oxidant, anti-inflammatory, antimutagenic, anti-tumour etc.

Presence of baicalein in S. colebrookiana and S. violacea might partly responsible for the observed pharmacological activities of these plants. The isolation and characterization of Ceropegin from ethyl acetate extract of root of Ceropegia bulbosa by using TLC analysis was made by Monika et al. (2012). The HPTLC chromatogram developed for methanolic extract of leaf of Gymnema sylvestre (Balamurali Krishna, 2012; Bakrudeen et al., 2013) noticed different number of peaks and \( R_f \) values 0.30 and 0.35 – 36 for gymnemic acid/gymnemagenin in Gymnema sylvestre collected from Gujarat and Maharashtra.

The \( R_f \) values between 0.66 to 0.82 for gymnemic acid were also reported in 17 different ecotypes of Gymnema sylvestre in Andra Pradesh. Similarly, the methanolic and petroleum ether whole plant extracts of Oxystelma esculentum showed \( R_f \) value of 0.50 for stigmasterol and aesculin and 0.70 for kaempferol after densitometric analysis at 254 nm (Devang and Indermeet, 2011a; 2011b; Pandya and Anand, 2011) while the extracts were subjected to densitometric analysis. The
presence of aesculin with $R_f$ values of 0.35 in methanolic extract of aerial part (Mridula et al., 2009), flavanoids with $R_f$ values between 0.05 – 0.95 at 366 nm in alcoholic and aqueous extracts of leaf (Ashoka Babu et al., 2012).

Polyphenols with several peaks and $R_f$ values at 254 nm in ethanolic extract of leaf (Rajeswari and Paramjyothi, 2013) and terpenoids such as oleanolic and urosilic acid with $R_f$ values of 0.31 and 0.49 at 366 and 522 nm in methanolic extracts of leaf (Gopal et al., 2013) in Wattakaka volubilis was also detected by using HPTLC finger printing analysis. Comparing the spectral characteristics of the peaks and banding pattern of our studies with earlier HPTLC analysis made with standards revealed that there could be possible occurrence of respective compounds in the extracts of the test species of the family Malvaceae, Sapotaceae and Lythraceae.

However, further investigations on qualitative and quantitative analysis along with standards of relevant phytochemical compounds should be undertaken. It may also be concluded that HPTLC method could serve as simple, rapid, reliable, reproducible, accurate and precise tool for quantitative monitoring and or authentication of medicinally active phyto-compounds of ceropegin, gymnemic acid, aesculin and aeridin and other different types of alkaloids and terpenoids in the selected species for the preparation of herbal products and to explore their pharmaceutical values. Biological activity of the plant extracts has given clue for the further isolation studies. In the present study methanol extract which has shown potent biological activity has been subjected to extraction, isolation and separation of the component.

From the methanol extract, polyphenols were extracted which were further separated and purified by isolation technique. Normal column chromatography along with thin layer chromatography was used as isolation technique. Column chromatography is a very simple chromatographic technique and has extensively been used for the purification of compounds from plant extracts. Thin layer chromatography (TLC) is another simple and cheap method used for the detection of various chemicals present in plants as it is reproducible, easy to run and
require simple instrument. It is also very much useful for monitoring the identity and purity of drugs, adulteration and substitutions as well. Furthermore it provides the semi-quantitative information on the major active constituents of drug.

In the present study the extracted phenolic compounds were subjected to Thin layer Chromatography by using toluene: ethyl acetate (7:3) as solvent system and the result indicated the presence of 4 spots with h $R_f$ value 0.84, 0.69, 0.45, and 0.39. These are further separated and purified by column chromatography over silica gel-H. Total of 50 fractions were collected and they were checked for its purity by HPTLC using toluene: ethyl acetate (7:3) and the fraction with single spots with same h $R_f$ value were pooled together. The obtained fraction is evaporated to dryness and named as compound 1. This is further subjected to physicochemical and spectroscopic studies to identify the compound. The physicochemical studies suggest that the isolated compound is white color powder with melting point 175-177°C and UV $\lambda_{max}$ 280nm.

The predetermination of MIC of crude solvent extracts of species of Malvaceae, Sapotaceae and Lythraceae noticed that MIC value was ranging from 10 – 60 mg/ml irrespective of solvents and adult parts of the species used in this study. The results of in vitro testing (Minimum inhibitory concentration) of seed crude extract of *Adansonia digitata* exhibited MIC values between 10-56 mg/ml (Table 13). Inhibition of crude extracts against the specific test organisms were measured in mg/ml. The extract restricted the growth of pathogens in the media. The 80% methanol crude seed extract of *Adansonia digitata* L. exhibited MIC values between 12-34 mg/ml against following manner: Aspergillus niger > Fusarium oxysporum > Alternaria buransii > Staphylococcus aureus > Bacillus subtilis > Escherichia coli > Salmonella typhi > Trichoderma harzianum.

The 80% acetone crude seed extract of *Adansonia digitata* L. exhibited MIC values between 12-56 mg/ml against following manner: Trichoderma harzianum > Aspergillus niger > Fusarium oxysporum > Salmonella typhi > Bacillus subtilis > Alternaria buransii > Staphylococcus aureus > Escherichia coli; 80% hexane crude seed extract of *Adansonia digitata* L. exhibited MIC values between 10-26
80% chloroform crude seed extract of *Adansonia digitata* L. exhibited MIC values between 12-27 mg/ml against following manner: Alternaria buransii > Salmonella typhi > Bacillus subtilis > Staphylococcus aureus > Aspergillus niger > Fusarium oxysporum > Trichoderma harzianum. 80% ethanol crude seed extract of *Adansonia digitata* L. exhibited MIC values between 12-39 mg/ml against following manner: Fusarium oxysporum > Aspergillus niger > Salmonella typhi > Trichoderma harzianum > Alternaria buransii > Escherichia coli > Staphylococcus aureus > Bacillus subtilis. And the last aqueous crude seed extract of *Adansonia digitata* L. exhibited MIC values between 11-31 mg/ml against following manner: Staphylococcus aureus > Trichoderma harzianum > Alternaria buransii > Fusarium oxysporum > Bacillus subtilis > Aspergillus niger > Salmonella typhi > Escherichia coli.

The results of in vitro testing (Minimum inhibitory concentration) of endosperm crude extract of *Adansonia digitata* exhibited MIC values between 11-32 mg/ml (Table 13). Inhibition of crude extracts against the specific test organisms were measured in mg/ml. The extract restricted the growth of pathogens in the media. The 80% methanol crude endosperm extract of *Adansonia digitata* L. exhibited MIC values between 12-25 mg/ml against following manner: Alternaria buransii > Fusarium oxysporum > Escherichia coli > Aspergillus niger > Trichoderma harzianum > Bacillus subtilis > Salmonella typhi > Staphylococcus aureus; 80% acetone crude endosperm extract of *Adansonia digitata* L. exhibited MIC values between 11-32 mg/ml against following manner: Aspergillus niger > Salmonella typhi > Bacillus subtilis > Escherichia coli > Fusarium oxysporum > Staphylococcus aureus > Trichoderma harzianum > Alternaria buransii; 80% hexane crude seed extract of *Adansonia digitata* L. exhibited MIC values between 12-24 mg/ml against following manner: Aspergillus niger > Fusarium oxysporum > Trichoderma harzianum > Bacillus subtilis > Staphylococcus aureus > Salmonella typhi > Escherichia coli > Alternaria buransii.
80% chloroform crude endosperm extract of *Adansonia digitata* L. exhibited MIC values between 11-23 mg/ml against following manner:

Staphylococcus aureus > Fusarium oxysporum > Bacillus subtilis > Alternaria buransii > Trichoderma harzianum > Aspergillus niger > Escherichia coli > Salmonella typhi; 80% ethanol crude seed extract of *Adansonia digitata* L. exhibited MIC values between 11-22 mg/ml against following manner:

Escherichia coli > Bacillus subtilis > Alternaria buransii > Trichoderma harzianum > Aspergillus niger > Fusarium oxysporum > Salmonella typhi > Staphylococcus aureus. And the last aqueous crude endosperm extract of *Adansonia digitata* L. exhibited MIC values between 12-24 mg/ml against following manner:

*Fusarium oxysporum* > *Staphylococcus aureus* > *Salmonella typhi* > *Escherichia coli* > *Alternaria buransii* > *Trichoderma harzianum.*

The results of in vitro testing (Minimum inhibitory concentration) of leaf extract of *Mimusops elengi* L. exhibited MIC values between 11-40 mg/ml (Table 13). Inhibition of crude extracts against the specific test organisms were measured in mg/ml. The extract restricted the growth of pathogens in the media. The 80% methanol crude leaf extract of *Mimusops elengi* L. exhibited MIC values between 12-37 mg/ml against following manner:

Escherichia coli > Aspergillus niger > *Staphylococcus aureus* > *Bacillus subtilis* > *Trichoderma harzianum* > *Alternaria buransii* > *Salmonella typhi* > *Fusarium oxysporum*; 80% acetone crude leaf extract of *Mimusops elengi* L. exhibited MIC values between 14-33 mg/ml against following manner:

*Bacillus subtilis* > *Aspergillus niger* > *Trichoderma harzianum* > *Escherichia coli* > *Salmonella typhi* > *Alternaria buransii* > *Fusarium oxysporum* > *Staphylococcus aureus;* 80% hexane crude leaf extract of *Mimusops elengi* L. exhibited MIC values between 11-33 mg/ml against following manner:

*Staphylococcus aureus* > *Aspergillus niger* > *Salmonella typhi* > *Bacillus subtilis* > *Alternaria buransii* > *Escherichia coli* > *Trichoderma harzianum* > *Fusarium oxysporum.*

The 80% chloroform crude leaf extract of *Mimusops elengi* L. exhibited MIC values between 11-26 mg/ml against following manner:

*Bacillus subtilis* > *Aspergillus niger* > *Salmonella typhi* > *Escherichia coli* > *Alternaria buransii* > *Fusarium oxysporum* > *Staphylococcus aureus* > *Trichoderma harzianum;*
80% ethanol crude leaf extract of *Mimusops elengi* L. exhibited MIC values between 12-33 mg/ml against following manner *Staphylococcus aureus* > *Trichoderma harzianum* > *Bacillus subtilis* > *Alternaria buransii* > *Escherichia coli* > *Salmonella typhi* > *Aspergillus niger* > *Fusarium oxysporum*. And the last aqueous crude leaf extract of *Mimusops elengi* L. exhibited MIC values between 12-34 mg/ml against following manner *Staphylococcus aureus* > *Bacillus subtilis* > *Escherichia coli* > *Trichoderma harzianum* > *Aspergillus niger* > *Salmonella typhi* > *Alternaria buransii* > *Fusarium oxysporum*.

The results of in vitro testing (Minimum inhibitory concentration) of leaf extract of *Woodfordia fruticosa* L. exhibited MIC values between 10-45 mg/ml (Table 13). Inhibition of crude extracts against the specific test organisms were measured in mg/ml. The extract restricted the growth of pathogens in the media. The 80% methanol crude leaf extract of *Woodfordia fruticosa* L. exhibited MIC values between 10-24 mg/ml against following manner *Escherichia coli* > *Fusarium oxysporum* > *Bacillus subtilis* > *Staphylococcus aureus* > *Salmonella typhi* > *Alternaria buransii* > *Trichoderma harzianum* > *Aspergillus niger*; 80% acetone crude leaf extract of *Woodfordia fruticosa* L. exhibited MIC values between 12-41 mg/ml against following manner *Aspergillus niger* > *Fusarium oxysporum* > *Staphylococcus aureus* > *Bacillus subtilis* > *Salmonella typhi* > *Escherichia coli* > *Alternaria buransii* > *Trichoderma harzianum*; 80% hexane crude leaf extract of *Woodfordia fruticosa* L. exhibited MIC values between 11-23 mg/ml against following manner *Bacillus subtilis* > *Escherichia coli* > *Staphylococcus aureus* > *Alternaria buransii* > *Aspergillus niger* > *Salmonella typhi* > *Fusarium oxysporum* > *Trichoderma harzianum*.

The 80% chloroform crude leaf extract of *Woodfordia fruticosa* L. exhibited MIC values between 13-21 mg/ml against following manner *Trichoderma harzianum* > *Escherichia coli* > *Staphylococcus aureus* > *Alternaria buransii* > *Aspergillus niger* > *Fusarium oxysporum* > *Salmonella typhi* > *Bacillus subtilis*; 80% ethanol crude leaf extract of *Woodfordia fruticosa* L. exhibited MIC values between 12-29 mg/ml against following manner *Alternaria buransii* > *Salmonella typhi* > *Fusarium oxysporum* > *Bacillus subtilis* > *Trichoderma harzianum* > *Escherichia coli* >
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Staphylococcus aureus > Aspergillus niger. And the last aqueous crude leaf extract of Woodfordia fruticosa L. exhibited MIC values between 12-29 mg/ml against following manner Fusarium oxysporum > Trichoderma harzianum > Staphylococcus aureus > Bacillus subtilis > Salmonella typhi > Alternaria buransii > Aspergillus niger > Escherichia coli.

Our observations were in accordance with previous studies reported that the MIC values of acetone and methanolic extracts Pentatropis capensis were between 25 to 100 mg/ml while tested against Gram positive and negative bacteria and several fungal pathogens (Rama Prabha et al., 2010). Similarly, it was between 50-100 mg/ml for methanolic leaf extract of Gymnema sylvestre (David and Sudarsanam, 2013). The MIC value was between 20 to 80 mg/ml for bacteria and fungi while using methanolic extracts of Chelidonium majum (Ciric et al., 2008) and it was ranging from 50 to 80 mg/ml for different methanolic extracts of stem, leaf and root of Vitellaria paradoxa (Ndukwe et al., 2007). Kishor Naidu et al. (2013) reported low MIC values from 15.6 mg/ml to 62.5 mg/ml of methanolic extract of Gymnema sylvestre for selected Gram positive and negative bacteria.

The studies carried out in Wattakaka volubilis highlighted that the methanolic extract exhibited low MIC between 5-20 mg/ml against Staphylococcus aureus (Kavitha Salkar et al., 2013) but the ethanolic leaf extract recorded MIC between 25 and 200 mg/ml for Staphylococcus aureus and few Gram negative bacteria (Natarajan and Arul Gnana Dhas, 2013). On the contrary, MIC of 25-100 µl of chloroform leaf extract of Wattakaka volubilis was employed for bioactivity assay made against microbial pathogens (Ramachandran et al., 2014). It has also been reported that chloroform and alcoholic extracts of leaf of Rauvolfia tetraphylla and Physalis mimina exhibited MIC values between 0.25 and 60 mg/ml against bacteria and fungi (Shariff et al., 2006). In a study It was observed that 2 mg/ml of different solvent extracts of roots and leaves of Lippia alba and 128 to 512 µg/ml of ethanolic leaf extract was used against microbial pathogens (Coutinho et al., 2008).

The high MIC values of adult parts extracted with some solvents especially in aqueous extracts (80 mg/ml) evidence that the bio-efficacy of those
extracts might be found possible only with adequate quantity of active phytosubstances to act against selected resistant Gram positive and negative bacteria tested in this study. Moreover, the potential of crude extracts at low MIC value (20 mg/ml) of some solvent extracts of selected species could be due to the fact that the crude extract was more viscous, not permeable and did not diffuse properly in the medium but after dilution it easily diffused into the medium (Parek et al., 2005). The observations that show variation in MIC values can be associated with qualitative and quantitative variation in phytocompounds assessed in the different solvents employed for preparation of crude extracts.

Comparatively, the MIC values of solvent extracts of adult parts of species of Malvaceae, Sapotaceae and Lythraceae were found higher than the positive control (amikacin for bacteria and ketakonazole for fungal pathogen). The study also implicated that the plant extracts could be effective at high concentration (between 40-80 mg/ml) against test microbial pathogens and thus 60 mg/ml of crude extracts of selected species were used for antimicrobial assay. The results on antimicrobial activity of various solvent extracts of adult parts of species of Malvaceae, Sapotaceae and Lythraceae recorded a different bioactive potential against tested microbial pathogens. It was also observed that in both of these plants, petroleum ether, ethyl acetate, methanolic and aqueous extracts had no appreciable inhibitory effect on the tested microorganisms. Similarly, the chloroform extract of leaf and stem of Gymnema sylvestre showed activity against the several microorganisms except Bacillus subtilis and also noticed highest inhibition zone against Escherichia coli and Klebsiella pneumoniae while using chloroform and methanolic leaf extracts of this species (Murugan and Mohan, 2012).

The methanolic and chloroform extracts of Gymnema sylvestre also noticed a high degree of antimicrobial activity against Escherichia coli and Candida albicans (David and Sundarsanam, 2013), Escherichia coli and Proteus sp. (Sripathi and Uma sankari, 2010), Escherichia coli, Serratia marcesens, Staphylococcus aureus and Candida albicans (Wani et al., 2012) and several Gram negative bacteria and Staphylococcus aureus (Kishor Naidu et al., 2013). On the other hand, petroleum ether and aqueous extracts of leaf and stem of Gymnema sylvestre found
effective against *Staphylococcus aureus*, Bacillus subtilis, *Pseudomonas aeruginosa*, *Salmonella typhi* and *Klebsiella pneumoniae* (Murugan and Mohan, 2012). In *Ceropegia juncea*, the methanolic extract of aerial parts of it noticed markable inhibitory activity against Gram negative bacteria viz., *Escherichia coli* (18.05 mm), *Pseudomonas aeruginosa* (17.05 mm) and *Klebsiella pneumoniae* (17.75 mm) whereas *Klebsiella pneumoniae* (18.05 mm) and *Proteus vulgaris* (17.05 mm) alone found sensitive to aqueous extract of *Ceropegia juncea* when these extracts compared with positive control.

The petroleum ether, chloroform and ethyl acetate extracts had poor zone of inhibition against the test organisms. It was recorded that chloroform extract of leaf of *Pentatropis capensis* found to have bio-efficacy in terms of inhibiting the fungal pathogen (17.05 mm) but it was not true with other microbial pathogens irrespective of solvents used for preparation of extracts. Concordantly, the acetone and methanolic extracts of leaves of *Pentatropis microphylla* used at 100 mg/ml exhibited zone of inhibition between 8-10 mm against some Gram positive and negative bacteria but not on par with efficacy of antibiotic kanamycin (21-28 mm) used as positive control (Rama Prabha et al., 2010). Nirmala et al., (2012) also observed that chloroform extracts of whole plant of *Pentatropis capensis* had antibacterial and antifungal activity while it was used at 50 µl of concentration ranging from 100 mg/ml to 300 mg/ml.

Moreover in the presence study, different solvent extracts of leaf of *Wattakaka volubilis* neither inhibited pathogenic bacteria nor fungus at significant level. Comparatively, the antimicrobial assay emphasizes that the species *Pentatropis capensis* and *Wattakaka volubilis* found to have less bio-efficacy against the tested infectious microorganisms with the 60 mg/ml concentration of crude solvent extracts. It was in confirm that the ethanolic extracts of leaf of *Dregea volubilis* which had appreciable inhibitory efficacy against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* and fungal species of *Aspergillus* only when the extracts used at concentrations between 100 and 200 mg/ml (Natarajan and Arul Gnana Dhas, 2013).
In another study, the chloroform leaf extract of *Wattakaka volubilis* was found effective at 100 µl against such pathogens (Ramachandran *et al*., 2014) but zone of inhibition was lesser than its standard antibiotic ofloxacin (10 mg/disc). The present results were also comparable to other genera of Asclepiadaceae i.e., *Tylophora indica* (Bashir *et al*., 2009), *Pergularia daemia* (Ignacimuthu *et al*., 2009), *Calotropis gigantea* (Kumar *et al*., 2010), *Pentatropis microphylla* (Rama Prabha and Vasantha, 2010) and *Leptadenia pyrotechnica* (Munazir *et al*., 2012) which have been proved to have significant antimicrobial activity. Although these selected plants have been previously studied for their antibacterial activity, the present study highlighted that the test species like *Oxystelma esculentum* and *Gymnema sylvestre* were found to have bioactive potential against the drug resistant Gram positive bacterium *Staphylococcus aureus* and the infectious Gram negative bacteria such as *Chromobacterium violaceum* and *Burkholderia mallei* which were not yet tested with solvent extracts of any of the test species of Malvaceae, Sapotaceae and Lythraceae.

It was also observed that methanolic and aqueous extracts of whole plant of *Ceropegia juncea* found to have inhibitory effect against few Gram negative bacteria wherein only little attempts were made. Moreover, the study evidences that adult plant extracts of species were bacteriostatic at lower concentrations and bacteriocidal at higher concentrations. The observations on antibacterial and antifungal activity of *Oxystelma esculentum*, *Gymnema sylvestre* and *Ceropegia juncea* clearly reflect that it could be associated with phytocompounds such as alkaloids, phenolics, tannins, aminoacids, flavanoids, steroids, saponins and glycosides which were reported to be effective antimicrobial substances against wide range of microorganisms (Okwu and Okwu, 2004; Wani *et al*., 2012; David and Sudarsanan, 2013).

For instance plants rich in tannins have antibacterial potential due to their basic character that allows them to react with proteins thereby killing the bacteria by directly damaging its cell membrane (Elmarie and Johan, 2001). The probable antibacterial action mechanisms of naturally phytocompounds of these species might also be related to disintegration of cytoplasmic membrane,
destabilization of the proton motive force (PMF), electron flow, active transport and coagulation of the microbial cell content along with other mechanisms such as inhibition of extra cellular microbial enzymes in various sites of pathogenic microbes (Hagerman, 2002; Silva and Fernandes, 2010). The results obtained further justify the ethnomedicinal uses of these plants as anti-infectious agents and also pave a way for finding new antimicrobials.

It can be concluded that, the selected dried parts of species of Malvaceae, Sapotaceae and Lythraceae represents a new source antimicrobial compound with stable, biologically active components that can establish a scientific base for the use in modern medicine. However, further studies are needed to isolate and characterize the bioactive principal to develop new antimicrobial drugs from these species for pharmaceutical applications.