General discussion and conclusion
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This exhaustive research work comprises the steps forwarded towards the phytochemical evaluation and therapeutic studies of the two very important medicinal plants namely *Eurya japonica* Thunb. and *Ficus auriculata* Lour. growing in the North eastern region of India.  

In the present study, it has been observed that most of the biologically active phytochemicals are present in the ethyl acetate, acetone, methanol and ethanol extract of these plants. The leaf extract of *Eurya japonica* Thunb. has shown the presence of alkaloids, carbohydrates, glycosides, tannins, flavonoids, saponin and steroid. The leaf extract of *Ficus auriculata* Lour. has shown the presence of alkaloids, carbohydrates, glycosides, tannins, flavonoids and steroid. However, saponin was found to be absent in the leaf extract of *Ficus auriculata* Lour.  

Savithramma *et al.*, 2011 studied the qualitative phytochemical analysis of 18 various medicinal plants. Phytomedicines from plants can be derived from any part of the plant like bark, leaf, flower, seed, etc i.e., any part of the plant may contain active components. Knowledge of the chemical constituents of plants is desirable because such information will be of value for the synthesis of complex chemical substances.  

Adesuyi *et al.*, 2012 investigated the nutritional and phytochemical screening of *Garcinia kola*. from its roots to its leaves, the plant *Garcinia kola* is known to contain several phytochemicals noted for their medicinal importance (Iwu *et al.*, 1990). The medicinal properties of *Garcinia kola* can be classified under purgative, antiparasitic and antimicrobial. From the study, it has been observed that through the nutritional screening of *Garcinia kola*, the plant has a good source of carbohydrate and protein content and the plant also has a good source of minerals necessary for metabolic activities in the human body. The phytochemical composition of *Garcinia kola* indicated the presence of the flavonoids, alkaloids, glycosides, phenols and saponins. The study concluded that the presence of various phytochemical compositions in the plant were useful in the pharmaceutical and medical science to make vaccine and supplements that can prevent various diseases.  

Theera *et al.*, 2013 investigated the phytochemistry and cytotoxic activity of the leaf, branch and fruit extracts of *Vatica diospyroides*, the study indicated that the different plant parts differ in their chemical composition. The results showed presence of terpenoids and anthraquinones whereas alkaloids were found to be absent. The leaf
and stem extracts contained flavonoids, Tannins and cardiac glycosides. Leaves and fruit contained saponins while the stem did not. This work revealed the potentials of *V. diospyroides* fruit as a cytotoxic agent against human breast cancer cell line. This may be due to the presence of various secondary metabolites that may exert anticancer activity through different mechanisms.

Phytochemical screening of medicinal plants is very important in identifying new sources of therapeutically and industrially important compounds. Therefore, these findings of phytochemicals were good enough to reflect their importance that can be used for further analysis on the medicinal properties of the plants under study.

It has been recorded that in the *in-vitro* antibacterial studies of the leaf extract of *Eurya japonica* Thunb. and *Ficus auriculata* Lour., both the plants has shown antibacterial activities. Four solvents (Petroleum ether, Ethyl acetate, Acetone and Ethanol) were chosen at varying concentrations i.e 50 mg/ml, 100 mg/ml, 150 mg/ml and 200 mg/ml respectively for the study of antibacterial activity of the leaf extracts. The fact that the organic solvent extracts of the plant materials exhibited greater antimicrobial activity because the antimicrobial principles were either polar or non-polar and they were extracted only through the organic solvent medium (Mohanasundari *et al.*, 2007; Britto, 2001). The present observation suggests that the organic solvent extraction was suitable to verify the antimicrobial properties of the medicinal plants and they are supported by many investigators (Krishna *et al.*, 1997; Singh and Singh, 2000; Natarajan *et al.*, 2003; Natarajan *et al.*, 2005). The plant extracts demonstrated a strong antibacterial activity against the bacterial organisms under study: *Staphylococcus aureus*, *Klebsella pneumonia*, *E. coli* and *Pseudomonas sp*. Results of the present investigation confirms the use of the plant leaf extracts in the folk medicine and as a source of antibacterial substance for the possible treatment of many diseases caused by bacterial infestation. The study showed that among the bacterial forms tested *Eurya japonica* Thunb. has shown good inhibitory effect against the organisms in the following order: *E. coli*, *Pseudomonas sp*, *Klebsella pneumonia*, and *Staphylococcus aureus*. The leaf extract of *Ficus auriculata* Lour. has also showed potent antibacterial activity against *E. coli*, *Pseudomonas sp.*, *Staphylococcus aureus* and *Klebsella pneumonia* respectively.

The presence of one or more of these secondary metabolites in the plants under study indicated that the antibacterial activity is due to these active compounds present in the
leaf extracts of the test plants namely *Eurya japonica* Thunb. and *Ficus auriculata* Lour.  

Girish and Satish, 2008 studied the leaf extracts of five different medicinal plants, which were used in the treatment of burns, dermatophytes and infectious diseases belonging to the different family viz. *Boerhaavia diffusa*, *Cassia auriculata*, *Cassia Lantana*, *Eclipta alba* and *Tinospora cardiofolia*. They studied the *in vitro* antibacterial activity by agar diffusion-method against the following bacteria viz., *Bacillus cereus*, *Bacillus megaterium*, *Bacillus subtilis*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Staphylococcus aureus*, *Streptococcus faecalis* and *Yersinia enterocolitica*. The results concluded that *Boerhaavia diffusa*, *Tinospora cardiofolia* and *Eclipta alba* had higher antibacterial activity compared to *Cassia auriculata* and *Cassia Lantana*. The study justifies the claim for the use of *Boerhaavia diffusa*, *Tinospora cardiofolia* and *Eclipta alba* in the traditional system of medicine to treat various infectious diseases caused by the microbes.

Mahalingam *et al.*, 2011 studied on the antibacterial activity of some medicinal plants against five human pathogenic microorganisms. Medicinal plants *Strychnos nuxvomica* and *Cassia angustifolia* were selected for antibacterial studies. The bacterial organisms were isolated from drinking water (*Bacillus*, *Borchothrix*, *Clavibacter sp*, *Anguslobacter sp*, and *Brevibacterium*). The results obtained in the study suggested that *Strychnos nuxvomica* and *Cassia angustifolia* could be used in treating diseases caused by the test organisms. The potential for developing antibacterials from higher plants appears rewarding as it will lead to the development of phytomedicine to act against microbes. Jayalakshmi *et al.*, 2011 studied the antibacterial activity of ten medicinal plants viz., *Clerodendrum inerme* L., *Terminalia chebula* Retz., *Curcuma amada* Roxb., *Foeniculum vulgare* Mill., *Piper longum* L., *Anacardium occidentale* L., *Duranta repens* L., *Piper betle* L., *Eucalyptus camaldulensis* Dehn., and *Euphorbia cotinifolia* L., which were selected based on their ethnomedicinal importance. The antibacterial activities were tested against the human pathogenic bacteria *Escherichia coli*, *Klebsiella pneumonia*, *Bacillus subtilis* *Bacillus cereus*, *Salmonella typhi*, *Enterobacter aerogenes* and *Staphylococcus aureus* by agar cup diffusion method. The study concluded that the antibacterial activity of the medicinal plants showed significant inhibition which was found to be promising when compared with the standard drugs streptomycin and gentamycin.
The demonstration of antibacterial activity against the bacterial microorganisms is an indication that there is possibility of searching alternative antibiotic compounds from the screened plants leading to the discovery of newer compounds. Based on this, further phytochemical and pharmacological studies are recommended.

In the in-vitro studies, methanol leaf extract of *Eurya japonica* Thunb. and *Ficus auriculata* Lour. have also shown antioxidant potential comparable to standard compound, ascorbic acid. The medicinal plants showed potential activity in scavenging of DPPH free radicals and reducing power activity. In the study, *Eurya japonica* Thunb. has shown higher potency in scavenging of the DPPH free radical as compared to that of *Ficus auriculata* Lour. This may be due to the presence of higher amount of phenolic and flavonoid content in the leaf extract of *Eurya japonica* Thunb. compared to *Ficus auriculata* Lour. This study supports the use of the leaf extracts of both *Eurya japonica* Thunb. and *Ficus auriculata* Lour. for the treatment of diabetes.

Pourmorad *et al.*, 2006 studied the antioxidant activity, phenol and flavonoid contents of some selected Iranian medicinal plants namely *Mellilotus officinalis* (Fabaceae), *Equisetum maximum* (Equisetaceae), *Plantago major* (Plantaginaceae), *Adiantum capillus-veneris* (Adiantaceae) and *Urtica dioica* (Urticaceae). The study concluded that all of the test plant extracts exhibited varied extent of antioxidant activity. The extract of *M. officinalis*, which contain highest amount of flavonoid and phenolic compounds, exhibited the highest antioxidant activity. The high scavenging property of *M. officinalis* may be due to the hydroxyl groups existing in the phenolic compounds’ chemical structure that can provide the necessary component as a radical scavenger. This may be co-related to the high amount of flavonoid and phenolic compounds present in this plant extract.

Prakash *et al.*, 2009 studied the antioxidant activities of 6 medicinal plants namely *Desmodium gangeticum* (Linn.), *Eclipta alba* (Linn.) *Ocimum sanctum* (Linn.), *Piper longum* (Linn.), *Solanum nigrum* (Linn.) and *Amaranthus caudatus* (Linn.). This study reveals that tested plant materials have moderate to significant antioxidant activity and free radical scavenging activity. The radical scavenging activity of the plants were in the order as *Desmodium gangeticum > Amaranthus caudatus > Solanum nigrum > Piper longum > Eclipta alba > Ocimum sanctum*. The therapeutic potential of natural medicinal plants as an antioxidant in reducing such free radical induced tissue injury, suggests that many plants have antioxidant activities that can be therapeutically useful (Kanatt *et al.*, 2007).
Nadeem et al., 2010 studied the comparative antioxidant activity, quantitative estimation of phenols and flavonoids in different parts of Aegle marmelos. The radical scavenging activity in the plant extracts decreased in the following order: Leaves > stem > root. The study revealed that the leaf extract of A. marmelos, holds maximum amount of flavonoid and phenolic compounds, exhibited the best antioxidant activity. This may be supported with the high amount of flavonoid and phenolic compounds present in the leaf extract of A. marmelos. Free radical mediated processes have been implicated in the pathogenesis of most of the diseases. It is well documented that free radicals take part in the pathogenesis of a large number of diseases (Gyamfi et al., 1999).

The results obtained in the above study supports the fact that more work needs to be done on the therapeutic potential of the leaf extracts of both the plants under study keeping in view to their in-vivo use.

The therapeutic study involves the study of acute toxicity, antihyperglycemic and antihyperlipidemic activity of the leaf extract of Eurya japonica Thunb. and Ficus auriculata Lour. in the streptozotocin induced diabetic mice. The leaf extracts of Eurya japonica Thunb. and Ficus auriculata Lour. have shown a dose dependent reduction of blood glucose level and this hypoglycemic effect was comparable with the standard oral hypoglycemic agent, glibenclamide. The biochemical parameters (antihyperlipidemic activity) of the streptozotocin induced diabetic mice showed reduced cholesterol, TG, LDL, VLDL and increased serum protein with improved HDL observed in the treatment with glibenclamide standard and methanol leaf extract of Eurya japonica Thunb. and Ficus auriculata Lour., whereas the untreated STZ-induced diabetic mice showed the rise in blood glucose level accompanied by an increase in the serum cholesterol, TG, LDL, VLDL and the decrease in serum protein and HDL level respectively, revealing the diabetic complications of the untreated mice. Histopathological studies of pancrease, liver and kidney of the treated streptozotocin induced diabetic mice showed the healing features, which is comparable to that of normal control mice. This is evident for the responsible hypoglycemic and hypolipidemic activity of the leaf extract of Eurya japonica Thunb. and Ficus auriculata Lour. respectively.

Sharangi, 2009 reviewed the medicinal and therapeutic potentialities of tea (Camellia sinensis L.). The medicinal effects of tea have a history dating back almost 5000 years. The chemical components of green tea chiefly include polyphenols, caffeine
and amino acids. Tea also contains flavonoids, compounds reported to have antioxidant properties having many beneficial effects. Tea contains flavonoids that can reduce inflammation, have antimicrobial effect and prevent tooth decay. Tea contains a compound theophylline, a licensed medicine for the treatment of respiratory diseases such as asthma. He further referred that upon animal studies of green tea revealed the properties to prevent development of Type 1 diabetes and slow the progression once it has developed. Insulin causes most of the body cells to take up glucose from the blood, storing it as glycogen in the liver and muscle, and stops use of fat as an energy source. When insulin is absent or low, glucose is not taken up by most body cells and the body begins to use fat as an energy source. People with Type 1 diabetes produce little or no insulin, a hormone that converts glucose (sugar), starches and other food items into energy needed for daily life. Tea polyphenols lower the serum glucose by inhibiting the activity of the starch digesting enzyme, amylase. Tea inhibits both salivary and intestinal amylase. As a result, the starch is broken down more slowly and the sudden rise in serum glucose is minimized. The inhibition of α-amylase from human saliva by polyphenolic components of tea and its specificity was investigated in vitro by Hara and Honda (1990). Type 2 diabetes mellitus is a common disease that interferes with the body’s ability to store energy from food. Risk factors for type 2 diabetes mellitus include being overweight, lack of exercise, and family history of the disease. Iso et al., 2006 opined from a study that people who were frequent drinkers of green tea (>6 cups per day) were less likely to develop this diabetes than those who drank less than one cup of these beverage per week. Ghosh et al., 2004 studied the hypoglycemic activity of Ficus hispida Linn. (bark) in normal and diabetic albino rats. The study showed that Ficus hispida has a significant reducing capacity of blood glucose level both in the normal and diabetic rats. However, the reduction in the blood glucose level was less than that of the standard drug, glibenclamide. Ficus hispida also increased the uptake of glucose by rat hemidiaphragm. There was a significant increase in the glycogen content of the liver, skeletal muscle and cardiac muscle. The amount of glycogen present in the cardiac muscle was more than the glycogen present in the skeletal muscle and liver. The study concluded that Ficus hispida has significant hypoglycemic activity. Increased glycogenesis and enhanced peripheral uptake of glucose are the probable mechanisms involved in its hypoglycemic activity.
Vivek *et al.*, 2010 studied the antidiabetic activities of leaf extract of *Ficus glomerata* in alloxan induced diabetic rats. The results indicated that *Ficus glomerata* leaf extract reduces the glucose level in animals made diabetic with alloxan. The results also indicate that *Ficus glomerata* leaf extract can reduce the levels of serum urea, serum creatinine, serum cholesterol and increase the serum protein and confirms the possibility that the major function of the extract are on the protection of vital tissues (Kidney and liver) including the pancreas, thereby reducing the causation of diabetes in the experimental animals. The study concludes that *Ficus glomerata* has beneficial effects on the blood glucose level as well as in improving hyperlipidemia and other metabolic aberrations.

Crude plant extracts are generally a mixture of active and non-active compounds. A number of medicinal plants described in Ayurveda still need to be testified according to the modern parameters to ensure their activity and efficacy. Therefore further exploration of these plants namely *Eurya japonica* Thunb. and *Ficus auriculata* Lour. for isolation of active compounds may be recommended.

Finally, isolation and characterization of the compound from the leaf extract of *Eurya japonica* Thunb. and *Ficus auriculata* Lour. were carried out. A compound was isolated from the leaf extract of *Eurya japonica* Thunb.(EJ-1). The IUPAC name of the isolated compound is:

6-(2-hydroxybenzyloxy)-3,4,5-trihydroxy-tetrahydro-2H-pyran-2-yl)methoxy)-3-methylpent-4-enal.

The structure of the compound is:
For optimization of bioactivity and to know the potency as antidiabetic property of the compound further research work is necessary.

A fraction was isolated from *Ficus auriculata* Lour. (FA-1). It was transpired that the fraction is a mixture of similar group of compounds which eluted together with column chromatography and which could not be separated through TLC. Therefore, further work on the extract of *Ficus auriculata* Lour. is suggested to corroborate with the findings on the antidiabetic activity of the extract and for the determination of bioactivity of the isolated fraction.