**International Journal of Zoology and Applied Biosciences** **ISSN: 2455-9571**
**Volume 5, Issue 1, pp: 6-11, 2020**
**https://doi.org/10.5281/zenodo.3665407**
**http://www.ijzab.com**
**Review Article**

# A REVIEW ON PHYTOCHEMICAL CHARACTERISTICS AND MEDICINAL VALUES OF *SESBANIA GRANDIFLORA* AND *CARICA PAPAYA*

***Premalatha, R., Nithya, R. and Saranya, A.**

Department of Microbiology and Biochemistry, Nadar Saraswathi College of Arts & Science, Theni-625531, India

**Article History:** Received 24th December 2019; Accepted 20th January 2020; Published 5th February 2020.

**ABSTRACT**

Plants have been used for their medicinal purposes right from the ancient days. The use of the plants has been mentioned in the unani manuscripts. There is always a demand for plan depended medicines, health products and cosmetics. *Sesbania grandiflora* (L) is a multipurpose tree with edible flowers and is a source of one of the medicinal products. The leaf extracts of *S. grandiflora* was found to have high antifungal activity than antibacterial activity. Various research results suggest that the leaves are a rich source of valuable primary and secondary metabolites exhibiting the antimicrobial activity. *Papaya carica* is an important fruit plant whose entire plant parts are useful in many ways. The papaya gains more attention due to its high proportion of vitamins and proteolytic enzymes. Both the plants gain more attention in recent days owing to their medicinal values.
**Keywords:** *Sesbania grandiflora*, *Carica papaya*, Antibacterial activity, Proteolytic enzymes.

## INTRODUCTION

The World Health Organization (WHO) recognizes traditional medicine, particularly plant medicine as an important alternative healthcare delivery system for most of the world's population. In recent years, drug resistance to human pathogenic bacteria has been commonly reported all over the world (Singh, 2007). There is a need to develop alternative antimicrobial drugs for the treatment of infectious diseases. One approach is to screen local medicinal plants for possible antimicrobial properties. Plant materials remain an important resource to combat serious diseases in the world. According to (1993), 80% of the world population is dependent on the traditional medicine and a major part of the traditional therapies involves the use of plant extract or their active constituents. Yet a scientific study of plants to determine their antimicrobial active compounds is a comparatively new field. The traditional methods, especially the use of medicinal plants, still play a vital role to cover the basic health needs in the developing countries.

The search for newer sources of antibiotics is a global challenge pre-occupying research institutions, pharmaceutical companies, and academia, since many infectious agents are becoming resistant to synthetic drugs (Latha & Kannabiran, 2006). Scientific experiments on the antimicrobial properties of plant constituents were first documented in the late 19th century (Zaika, 1988). It is estimated that today, plant materials have provided the models for 50% western drugs (Robbers *et al*., 1996). Many commercially proven drugs used in modern medicine were initially used in crude form in traditional for folk healing practices, or for other purposes that suggested potentially useful biological activity. The primary benefits of using plant derived medicines are that they are relatively safer than synthetic alternatives, offering profound therapeutic benefits and more affordable treatment. The medicinal plants around the world contain many compounds with antibacterial activity (Cowan, 1999).

Many efforts have been made to discover new antimicrobial compounds from various sources such as microorganisms, animals and plants. Systematic screening of them may result in the discovery of novel effective antimicrobial compounds. The use of botanical medicines is generally on the rise in many parts of the world (Bbosa *et al*., 2007). The screening of plant extracts and plant products for antimicrobial activity has shown that plants represent a potential source of new anti- infective agents (Amani *et al*., 1997). Since prehistoric times, man has used

*Corresponding Author: Dr. R. Premalatha, Assistant Professor, Department of Microbiology & Biochemistry, Nadar Saraswathi College of Arts & Science, Theni- 625 531. Email: premavenkat06@gmail.com

plants for various purposes and he will continue to do so as long as life continues on this planet (Leakey, 1991).

Man's symbiotic relationship over time with plants has given the world many invaluable benefits. Apart from the raw materials that go to form our variety of foods, the most important plant products are medicines, cosmetic and flavour products, as well as other pharmaceuticals (Sofowora, 1996). The Centre for Research in Plant Medicine has identified one thousand medicinal plants in Ghana and forty of them are used in treatments of thirty-three diseases such as: malaria, jaundice, asthma, diabetes, epilepsy, typhoid fever, hypertension and anemia (Yidana & Bayorbor, 2002).

**Screening of Phytochemical Constituents**

Various medicinal properties have been attributed to natural herbs. Medicinal plants constitute the main source of new pharmaceuticals and healthcare products (Ivanova *et al*., 2005). The history of plants being used for medicinal purpose is probably as old as the history of mankind. Extraction and characterization of several active phytocompounds from these green factories have given birth to some high activity profile drugs (Mandal *et al*., 2007). A growing body of evidence indicates that secondary plant metabolites play critical roles in human health and may be nutritionally important. Phytochemical screening of plants has revealed the presence of numerous chemicals including alkaloids, tannins, flavonoids, steroids, glycosides, saponins etc. Secondary metabolites of plants serve as a defense mechanism against predation by many microorganisms, insects and herbivores (Lutterodt *et al*., 1999). Flavonoids are a broad class of plant phenolic that are known to possess a well-established protective ability against membrane lipoperoxidative damages (Sen *et al.*, 2005). Phenolic compounds are one of the largest and most ubiquitous groups of plant metabolites that possess an aromatic ring bearing one or more hydroxyl constituents (Singh, 2007). The Phenolic compounds are widely found in the secondary products of medicinal plants, as well as in many edible plants. Plant based anti-bacteria have enormous therapeutic potential as they can serve the purpose with lesser side effects that are often associated with synthetic antibacterial. Biomolecules of plant origin appear to be one of the alternatives for the control of these antibiotic resistant human pathogens.

Knowledge of the chemical constituents of plants is desirable, not only for the discovery of therapeutic agents, but also because the medicinal value of plant lies in the chemical substances that produce a definite therapeutic action on the human body. Some of these important bioactive compounds are alkaloids, flavonoids, tannins and phenolic compounds. In addition, the knowledge of the chemical constituents of plants would further be valuable in the discovery of the actual value of folkloric remedies. The phytochemical research based on ethnopharmacological information is generally considered an effective approach in the discovery of new anti-infective agents from higher plants (Chhetri *et al*., 2008).

**Botanical Description**

*Sesbania grandiflora* is a small, loosely branching tree that grows up to 8-15 m tall and 25-30 cm in diameter; stems tomentose, unarmed; roots normally heavily nodulated with large nodules; the tree can develop floating roots. Leaves alternate and compound; pinnate 15-30 cm long with 12-20 paris of oblong, rounded leaflets, 3-4 cm long and about 1 cm wide; Leaves borne only on terminal ends of branches; leaves turn bright yellow before shedding. Flower clusters hanging at leaf base have 2-5 large or giant flowers; pink, red or white, pea like, 5-10 cm in length, curved about 3 cm wide before opening. Pods long and narrow, hanging down 30-50 cm by 8 mm; septate, wide, flat, with swollen margins and about 15-40 pale-colored seeds; seed is beanlike, elliptical, red brown, 6-8 in a pod, 3.5 mm. Flowering in sharadritu and fruition in winter. Fruit and flower are used as vegetable and as pickles (Orwa *et al*., 2009).

**Traditional Medicinal Uses**

The root-bark of the red-flowered variety is useful in vitiated condition of vata and arthralgia. The bark is astringent, cooling, bitter, tonic, anthelmintic and febrifuge the pounded bark is externally applied to cure Scabies. The juice of the bark is good for dyspepsia, diarrhea and gastralgia. The leaves are acrid, bitter, Sweet, cooling, aperient, tonic and diuretic and contain a non-poisonous saponins like substance. The leaf juice is used is nasal catarrh, nyctalopia and cephalagia. Leaves are chewed to disinfect mouth and throat and are useful in stomatalgia. The flowers are cooling, bitter, astringent, acrid and antipyretic. The juice of the flowers is applied to the eyes for nyctalopia and is used for intermittent fevers. The fruits are sweet, bitter, laxative and alexiteric and are useful in flatulent – colic, astringent, cooling, bitter, tonic, anthelmintic, febrifuge, cure scabies, dyspepsia, diarrhea and gastralgia, astringent, antipyretic, for nyctalopia, anemia, emaciation and vitiated conditions of tridosa.

Medicinal plants are a significant source of producing compounds which are great importance for the health of individuals and communities (Tamizhazhagan *et al*., 2017). World is endowed with a rich wealth of medicinal plants. Man cannot survive on this earth for long without the plant kingdom because the plant products and their active constituents played an important role. Medicinal plants have been used to cure a number of diseases. Though the recovery is slow, the therapeutic use of medicinal plant is becoming popular because of its inability to cause side effects. Commercially available antibiotics caused many side effects because of its component. *S. grandiflora* one of the medicinal plants used for antioxidant activities. It contains several kinds of alkaloids, flavonoids, saponins, tannin, triterpenoids, glycosides and phenols. Many researchers have evaluated that these phytochemical substances have major impact on diabetes (Pan *et al*., 2002).

Among these three extracts ethanol extracts have shown good antibacterial activity compared with aqueous

and acetone extracts. Because of the presence of alkaloids, flavonoids, tannins and steroids, ethanol extract shows high antibacterial activity. So these active compounds can be used in the field of medicine as therapeutic agent (Padmalochana & Rajan, 2014). These chemical constituents are well known for their potential health benefits and have been reported to possess valuable biological activities such as antibacterial and antifungal, antioxidant, antiurolithiatic, anticonvulsant and antiolytic and hepatoprotective properties. A number of experiments have been carried out on *S. grandiflora* to assure its analgesic and CNS depressant effects, cardioprotective effects and kindly protective effects on mice. Bark juice is given in diarrhea and abdominal colic and also gastric-intestinal disorders and wound healing activity of its flower due to having tannin and other nutritious content (Reeta *et al*., 2013).

Traditionally *S. grandiflora* is used alone or with other medicinal plants to treat a variety of ailments. Research studies leading to extraction, isolation and biological study of plant constituents have now formed the major field of study. In recent years, ethno medicinal studies received much attention as this brings to light the numerous little known and unknown medicinal virtues especially of *S. grandiflora* revealed as a valuable medicinal plant with several medicinal properties (Roy *et al*., 2014). Detection of the bioactive chemical constituents of *Sesban* leaves extract by a qualitative analysis for each ethanol and methanol extract It further reflects a possibility for the development of many more novel chemotherapeutic agents or templates from the plant which in future may serve for the production of improved therapeutic plant based drugs (Gomase, 2012).

As per the antimicrobial investigations in the presence study the CLP (Crude Leaf Power) of *S. grandiflora* exhibited low level antibacterial activity but the NPL (Nanosized Leaf Power) exhibited highest level of antibacterial activity. Antimicrobial activity of crude leaf power and nanosized leaf power was determined. According to the results, the antimicrobial activity of nanosized leaf power was very potent due to its uniform size when compared with crude leaf power. It was found that the nanosized leaf power had a high ability to kill microbes (Reji & Alphonse, 2013)**.** The benefits of papaya owed due to high content of vitamins A, B and C proteolytic enzymes like papania and chymopapain which have antiviral, antifungal and antibacterial properties. The present article reviews the pharmacological use of *Carica papaya* and side/toxic effects. *C. papaya* contains an enzyme known as papain which is present in the bark, leaves and fruit. *C. papaya* is a neutraceutical plant having a wide range of pharmacological activities. The wide range of enzymes, vitamins present in *C. papaya* makes it a neutraceutical plant (Yogiraj *et al*., 2014). Papaya is commonly known for its food and nutritional values throughout the world (Nirosha & Mangalanayaki, 2013).

Papaya leaf and stem extracts were tested against both gram positive and gram negative bacteria such as *staphylococcus aureus, streptococcus pneumonia, Bacillus cereus, Salmonella typhi, Escherichia coli* and *Pseudomonas aeroginosa* by diffusion method. *Carica papaya* may be used for the treatment of gastroenteritis urethritis media, typhoid fever and wound infections (Pandey *et al*., 2015). The antimicrobial properties of plant have been investigated by a number of studies worldwide and many of them have been used as therapeutic alternatives because of their antimicrobial properties. Plants are the cheaper and safer alternative source of antimicrobials. The study deals with the antibacterial activity of aqueous, ethanol and ethyl ether extract of leaves of *C. papaya* through agar well diffusion (Anibijuwon & Udeze, 2009).

The bioactive compound of leaf and root extracts of *C. papaya* was extracted, using water and organic solvents, and were investigated for antibacterial activity against some human pathogenic bacteria using the agar diffusion method. The aqueous extracts of the root extracts did not show significant activity, but the organic extracts had significant activity with the methanol extracts demonstrating the highest activity against the test bacteria (Boshra & Tajul, 2013). It is low in calories and rich in natural vitamins and minerals, like vitamin c, vitamin A, thiamine, iron and fibre. Papaya has been much studied in pharmaceutical and has wide applications in the food industry. The delicious papaya fruit has nutritional values that make it potent as a raw material in the food processing industry beyond mere raw consumption (Patil *et al*., 2014). Many scientific studies been conducted to the same end. Yet there is deficiency and opportunity to enlarge the framework of the research to include research to Parkinsonism and oxidant related damage (Krishna *et al*., 2008).

During the last few decades' considerable progress has been achieved regarding the biological activity and now it is considered as valuable nutraceutical fruit plant. Papaya popularly known as food article is the unique source of various types of compounds having diverse structure (Arumugam *et al*., 2014)**.** The presence of various phytochemical compounds in *Cynogon dactylon* and *C. papaya* was qualitatively and quantitatively determined by various standard of analysis. The suitable extraction method was identified for phytochemical compound extraction in above selected plants. The present study revealed that ethanol is a suitable solvent system which showed the presence of high percentages in the range of 0.01 to 1.46 and 0.02 to 10.0 percentage of phytochemicals compared to other solvent extracts (Doughari *et al*., 2007).

The bioactive compounds of root extract of *C. papaya* were extracted, using water and organic solvents and were investigated for antibacterial activity against some pathogenic bacteria using the cup plate agar diffusion method. Further pharmacological evaluations, toxicological studies and therapeutic antibacterial from this plant are the further challenges (Aruljothi *et al*., 2014). Nowadays, there is an increased sustained interest in the production of plant-based drugs for the treatment of many diseases. Moreover; people are welcoming traditional medicines to overcome mild/serious illness. Due to increase in the thrust for the

production of plant-based antimicrobials, the present study was performed on *C. papaya* leaves. The results obviously justified the importance of topical application of papaya leaf extracts to treat the wound infection as a traditional practice(Peter *et al*., 2014).

The aqueous as well as the methanolic extract of seeds were effective to inhibit the bacterial pathogens while in case of chloroform extract of *C. papaya*, leaves did not show any inhibition against the bacteria and the aqueous leaf extract was potent to inhibit them(Orhue & Momoh, 2013). Aside its nutritional values, there are speculations that *C. papaya*, also known as paw. Paw, has antibacterial potentials. This study evaluates the antibacterial potentials of different extracts of *C. papaya* parts, in comparison with standard drugs. These suggest that *C. papaya* may be used as an antibiotic and extracts in petroleum ether seems more potent (Kayalvizhi *et al*., 2015). Leaves of female *C. papaya*. were Shaded, powdered and were extracted using different solvents ethanol, methanol, acetone, chloroform, petroleum ether, hexane and ethyl acetate. It is very necessary to introduce new and biologically safe and active drugs eco-friendly in nature and effective as antibacterial agents (Chidozie & Adoga, 2014). These were tested against S*almonella typhi* and six other bacteria by agar gel diffusion method and the zones of inhibition recorded. This inferred that *Anogeissus leiocarpus* aqueous leaf extract had a potentiating effect on the antibacterial activities of the other two plant extracts. The combination of these plants has greater antibacterial actions than any single one of the plants appears to have a potentiating effect on the other two plants(Kumar & Dhanyaraj, 2016).

Plants have been one of the important sources of medicines since the beginning of human civilization. There is a growing demand for plant based medicines, health products, pharmaceuticals, food supplements and cosmetics. *S. grandiflora* is a multipurpose tree with edible flowers and is a source of one of the medicinal products. *S. grandiflora* has unique medicinal properties and used as a herbal drug for its antibiotic, anthelmintic, antitumor and contraceptive properties. Therefore, future research should be addressed on the application of using *S. grandiflora* leaves as natural remedy and to protect against infectious diseases (Gomathinayagam *et al*., 2013). The plant extract displays antimicrobial activity and therefore justifies its ethnobotanical uses for the treatment of ophthalmic, coughs, colic and haemorrhoids (Elgadir *et al*., 2014). Extracts from different parts of *C. papaya* plant have shown protective effects against many diseases such as intestinal worm's infection and different types of wounds. As a conclusion *C. papaya* is one of the most effective sources of natural medicine and widely used in pharmacological applications. It is used to treat several diseases such as tumors, nervous, asthma and wounds(Chávez Quintal *et al*., 2011).

An ethanol extraction was used to obtain bioactive compounds from *C. papaya*. The extract exhibited the broadest action spectrum. Ethanolic extracts from *C. papaya* Maradol leaves are a potential source of secondary metabolities with antifungal properties (Vij & Prashar, 2015). Papaya is a popular and important fruit tree in tropical and subtropical parts of the world. The fruit is consumed worldwide as fresh fruit and vegetable are used as processed product. The fruit is healthy and delicious and the whole plant parts including fruit, root, bark, peel, seeds and pulp are known to have medicinal properties. The many benefits of papaya are owed due to high content of vitamin A, B and C, proteolytic enzymes like papain and chymopapain. It has antiviral, antifungal and antibacterial properties (Lohidas *et al*., 2015)**.** The fresh and dried leaves of *C. papaya* has antibacterial and antifungal ability (Chowdhury *et al*., 2012).

## CONCLUSION

The efficacy of treatment with *C. papaya* is dependent on the quantity of the different chemical substances present in the preparation. The quantity of chemical substances varies in the fruit, latex, leaves, and roots and varies with the extraction method, age of the plant part, and the cultivar and sex of the tree. The extraction of fruit of *S. grandiflora* was carried out by using solvent aqueous methanol. The antioxidant activity of plant *S. grandiflora* was determined by in vitro antioxidant assays. It was found to have potent antioxidant activity, which may be due to the abundance of phenolic and flavonoid contents.

## ACKNOWLEDGMENT

The authors express sincere thanks to the head of the Department of Microbiology & Biochemistry, Nadar Saraswathi College of Arts & Science, Theni for the facilities provided to carry out this research work.

## REFERENCES

Amani, S., Isla, M., Vattuone, M., Poch, M., Cudmani, N., & Sampietro, A. (1997). *Antimicrobial activities in some Argentine medicinal plants.* Paper presented at the II WOCMAP Congress Medicinal and Aromatic Plants, Part 2: Pharmacognosy, Pharmacology, Phytomedicine, Toxicology 501.

Anibijuwon, I., & Udeze, A. (2009). Antimicrobial activity of *Carica papaya* (pawpaw leaf) on some pathogenic organisms of clinical origin from South-Western Nigeria. *Ethnobotanical Leaflets, 2009*(7), 4.

Aruljothi, S., Uma, C., Sivagurunathan, P., & Bhuvaneswari, M. (2014). Investigation on antibacterial activity of Carica papaya leaf extracts against wound infection-causing bacteria. *International Journal Research Studies Bioscience, 2*(11), 8-12.

Arumugam, N., Tualasinathan, B., Rajarajeswari, P., & Duraimurugan, M. (2014). Antimicrobial activity and phytochemical screening of Cynodon dactylon and Carica papaya. *Research in Biotechnology, 5*(5).

Bbosa, G., Kyegombe, D., Ogwal-Okeng, J., Bukenya-Ziraba, R., Odyek, O., & Waako, P. (2007).

Antibacterial activity of *Mangifera indica* (L.). *African Journal of Ecology, 45*, 13-16.

Boshra, V., & Tajul, A. (2013). Papaya-an innovative raw material for food and pharmaceutical processing industry. *Health Environment Journal, 4*(1), 68-75.

Chávez-Quintal, P., González-Flores, T., Rodríguez-Buenfil, I., & Gallegos-Tintoré, S. (2011). Antifungal activity in ethanolic extracts of *Carica papaya* L. cv. Maradol leaves and seeds. *Indian Journal of Microbiology, 51*(1), 54-60.

Chhetri, H. P., Yogol, N. S., Sherchan, J., Anupa, K., Mansoor, S., & Thapa, P. (2008). Phytochemical and antimicrobial evaluations of some medicinal plants of Nepal. *Kathmandu University Journal of Science, Engineering and Technology, 4*(1), 49-54.

Chidozie, V., & Adoga, G. (2014). Potentiating effect of aqueous leaf extract of *Anogeissus leiocarpus* on Carica papaya aqueous leaf extract and Mangifera indica aqueous stem bark extract-A herbal product used against typhoid fever in Nigeria. *International Journal of Current Microbiology Applied Science, 3*(10), 1046-1062.

Chowdhury, S.R., Maleque, M., & Shihan, M.H. (2012). Development and validation of a simple RP-HPLC method for determination of caffeine in pharmaceutical dosage forms. *Asian Journal of Pharmaceutical Analysis, 2*(1), 1-4.

Cowan, M.M. (1999). Plant products as antimicrobial agents. *Clinical Microbiology Rreviews, 12*(4), 564-582.

Doughari, J., Elmahmood, A., & Manzara, S. (2007). Studies on the antibacterial activity of root extracts of Carica papaya L. *African Journal of Microbiology Research, 1*(3), 037-041.

Elgadir, M. A., Salama, M., & Adam, A. (2014). Carica Papaya as a Source of Natural Medicine and Its Utilization in Selected Pharmacetical Applications. *International Journal Pharmacetual Pharma Science, 6*(1), 880-884.

Gomase, P. V. (2012). Sesbania sesban Linn: a review on its ethnobotany, phytochemical and pharmacological profile. *Asian Journal of Biomedical and Pharmaceutical Sciences, 2*(12), 11.

Gomathinayagam, S., Rekha, G., & Ori, L. (2013). Antibacterial Activities of Ethanolic Leaf Extract of *Carica papaya* on Escherichia coli and *Staphylococcus* aureus. *Journal of Pure and Applied Microbiology, 7*, 471-474.

Ivanova, D., Gerova, D., Chervenkov, T., & Yankova, T. (2005). Polyphenols and antioxidant capacity of Bulgarian medicinal plants. *Journal of Ethnopharmacology, 96*(1-2), 145-150.

Kayalvizhi, K., Cathrine, L., & Banu, K.S. (2015). Phytochemical and antibacterial studies on the leaf extracts of female *Carica papaya*. linn. *International Journal of PharmTech Research, 8*(7), 166-170.

Krishna, K., Paridhavi, M., & Patel, J.A. (2008). Review on nutritional, medicinal and pharmacological properties of Papaya (*Carica papaya* Linn.). *Indian Journal of Natural Products and Resources*, 364-373

Kumar, N., & Dhanyaraj, F. (2016). Phytochemical analysis and antimicrobial activities of Sesbania grandiflora (L) leaf extracts. *International Journal. Pharmactical Science Reviwe Research, 36*, 144-148.

Latha, P.S., & Kannabiran, K. (2006). Antimicrobial activity and phytochemicals of *Solanum trilobatum* Linn. *African Journal of Biotechnology, 5*(23).

Leakey, R. (1991). Useful Plants of Ghana: West African uses of wild and cultivated plants. By DK Abbiw. London: Intermediate Technology Publications (1990), pp. 337, paperback£ 9.95, hardback£ 30.00. *Experimental Agriculture, 27*(3), 341-341.

Lohidas, J., Manjusha, S., & Jothi, G.G.G. (2015). Antimicrobial activities of *Carica papaya* L. *Plant Architecture, 15*, 1179-1186.

Lutterodt, G., Ismail, A., Basheer, R., & Baharudin, H.M. (1999). Antimicrobial effects of *Psidium guajava* extract as one mechanism of its antidiarrhoeal action. *The Malaysian Journal of Medical Sciences, 6*(2), 17.

Mandal, V., Mohan, Y., & Hemalatha, S. (2007). Microwave assisted extraction an innovative and promising extraction tool for medicinal plant research. *Pharmacognosy Reviews, 1*(1), 7-18.

Nirosha, N., & Mangalanayaki, R. (2013). Antibacterial activity of leaves and stem extract of *Carica papaya* L. *International Journal Applied Pharmactical Biological Science, 2*(3), 473.

Orhue, P., & Momoh, A. (2013). Antibacterial activities of different solvent extracts of Carica papaya fruit parts on some gram positive and gram negative organisms. *International Journal of Herbs and Pharmacological Research, 2*(4), 42-47.

Orwa, C., Mutua, A., Kindt, R., Jamnadass, R., & Simons, A. (2009). Agroforestree Database: a tree reference and selection guide. Version 4. *Agroforestree Database: A tree reference and selection guide. Version 4.*

Padmalochana, K., & Rajan, M. D. (2014). Antimicrobial activity of Aqueous, Ethanol and Acetone extracts of Sesbania grandiflora leaves and its phytochemical characterization. *International Journal of Pharma Sciences and Research , 5*(12), 957-962.

Pan, G.Y., Wang, G.J., Liu, X. D., Fawcett, J.P., & Xie, Y. Y. (2002). The involvement of P-glycoprotein in berberine absorption. *Pharmacology & Toxicology, 91*(4), 193-197.

Pandey, B., Chandrakar, V., & Deshpande, B. (2015). Study of antibacterial activity of crude extract of leaves of Carica papaya. *Indian Journal of Life Sciences*, *5*(1), 33.

Patil, T., Patil, S., Patil, A., & Patil, S. (2014). Carica papaya leaf extracts–An Ethnomedicinal boon. *International Journal of Pharmacognosy and Phytochemical Research*, *6*(2), 260-265.

Peter, J.K., Kumar, Y., Pandey, P., & Masih, H. (2014). Antibacterial activity of seed and leaf extract of Carica Papaya var. Pusa dwarf Linn. *Journal of Pharmacy and Biological Sciences*, *9*(2), 29-37.

Reeta, M., Ravindra, S., Akhilesh, M., & Murthy, R. (2013). Agastya (*Sesbania grandiflora* Linn.): Ayurvedic approach. *University Joural Publication*, *2*(04), 1-5.

Reji, A.F., & Alphonse, N.R. (2013). Phytochemical study on Sesbania grandiflora. *Journal of chemical and pharmaceutical Research*, *5*(2), 196-201.

Robbers, J.E., Speedie, M.K., & Tyler, V.E. (1996). *Pharmacognosy and Pharmacobiotechnology*: Williams & Wilkins.

Roy, A., Bhoumik, D., Sahu, R.K., & Dwivedi, J. (2014). Phytochemical screening and antioxidant activity of Sesbania grandiflora leaves extracts. *Asian Journal of Research in Pharmaceutical Science*, *4*(1), 16-21.

Sen, G., Mandal, S., Roy, S.S., Mukhopadhyay, S., & Biswas, T. (2005). Therapeutic use of quercetin in the control of infection and anemia associated with visceral leishmaniasis. *Free Radical Biology and Medicine*, *38*(9), 1257-1264.

Singh, A. (2007). Phcog Rev. A Report Herbal Medicine–Dream Unresolved. *Pharmacognosy Reviews*, *1*(2).

Sofowora, A. (1996). Research on medicinal plants and traditional medicine in Africa. *The Journal of Alternative and Complementary Medicine*, *2*(3), 365-372.

Tamizhazhagan, V., Pugazhendy, K., Sakthidasan, V., & Jayanthi, C. (2017). Preliminary screening of phytochemical evaluation selected plant of Pisonia alba. *International Journal Biological Research*, *2*(4), 63-66.

Vij, T., & Prashar, Y. (2015). A review on medicinal properties of Carica papaya Linn. *Asian Pacific Journal of Tropical Disease*, *5*(1), 1-6.

Yidana, J., & Bayorbor, T. (2002). The multi-purpose value of medicinal plants and the potential for their cultivation. *Journal of the Ghana Science Association*, *4*(2), 146-158.

Yogiraj, V., Goyal, P.K., Chauhan, C.S., Goyal, A., & Vyas, B. (2014). Carica papaya Linn: an overview. *International Journal of Herbal Medicine*, *2*(5), 01-08.

Zaika, L.L. (1988). Spices and herbs: their antimicrobial activity and its determination 1. *Journal of Food Safety*, *9*(2), 97-118.