International Journal of Chemical and Biochemical Sciences
(ISSN 2226-9614)

Journal Home page: www.iscientific.org/Journal.html

A review of the pharmacological potential and phytochemical profile of weeping Fig - *Ficus benjamina* L.

Mohamad Fawzi Mahomoodally[1], Farwa Asif[2], Rafia Rahman[2]and Aniqa Ishaq[2], Shafaq Nisar[2]*

[1]Department of Health Sciences, Faculty of Science, University of Mauritius, Mauritius and [2]Department of Chemistry, University of Agriculture, Faisalabad, Pakistan

Abstract

The genus "Ficus" is an individual from the Moraceae family, growing in tropical and subtropical districts and incorporates more than 800 plant species. *Ficus benjamina* L., is a medium size tree with a few spreading branches from the base usually called "sobbing fig", is found in the neighborhood of South Africa, Australia, tropical focal Africa and West Africa. It is known for its restorative ability and people make use of this plant to manage and/or treat skin ailments, infections, intestinal illnesses, and retching. In addition, they are commonly used as anti-microbial, anti-pyretic and anti-nociceptive agents. The leaves, barks and roots contain bioactive compounds such as cinnamic acids, lactose, naringenin, quercetin, caffeic acid and stigma sterol with documented pharmacological properties.

Keywords: Africa, nnociceptive, Moraceae, cinnamic acids, quercetin, infection

Full length article **Corresponding Author*, e-mail: shafaqnisar12@gmail.com, Tel: +923237628206

1. Introduction

Essential oils are complex mixture of hydrophobic volatile organic compounds extracted from different plant species having high medicinal importance and extreme therapeutic potentials [1-16]. Weeping fig (*Ficus benjamina* L.) is an annual tree belonging to the family mulberry (Moraceae). It has been used for thousands of the years as an ornamental and hedge plant [17-24]. *Ficus* is a large genus of about 40 genera and 1000 species of trees, shrubs, lianas, or rarely herbs and many varieties are native to Asia, Australia, and parts of the Pacific region [24-25]. The uncertainty in the exact number of spices within the genus is largely attributed to the great variability among the constituents. Weeping fig cross-pollinates very easily that result in its diversity and variation [26]. For pollination, wasps play an important role for reproduction of this species. Members of this genus are hard to differentiate by their flowers, but can be distinguished by their pattern, whether they are weeping fig or not, by leaf shape, and by their fruits [27-28]. *Ficus benjamina* is known by different names depending on the geographical distribution. The common English names are famously as Benjamin tree, or oval leaf fig, Benjamina fig and weeping fig tree [29-30]. Common vernacular names are 'balete' or 'salisi'. In India specifically, it is best known as 'pukar'. In Chinese it is called 'Chui ye rong' or 'Cong Mao Chui ye rong'. In different regions of Brazil is known by different names beringan and *Figueira benjamina*. In Germany, it is known as 'Benjamin Feige'. In Indonesia, it is famous by the name of 'beringin', 'wariengin'. In Israel, it is called 'ficus ha'shderot'. In Myanmar, it is called 'nyaung thabye'. In Netherlands, it is known as 'Baniaanboom'. In Thailand, it is called 'sai yoi bai laem' [31-33].

Ficus benjamina is the most diverse species within the range. Large numbers of cultivars are available, but the exact numbers are unknown. The cultivars also vary in flavors and uses. *Ficus benjamina* is a tree reaching 30 meters under natural conditions [34]. Leaves are ovate-elliptic, slender-pointed, thin leathery, dark green and shiny, glossy and 2-5 cm long. Flowers are insignificant and minute; and sometimes borne in a hollowed out stem in axils but these flowers are not showy [17]. Wide range of the species is due to the glossy oval foliage. The plant is available as a natural looking bush and grow as an ornamental plant in different places such as parks and across the roadside [35].

Different factors like plant part, maturity of the plant part and agro-climatic conditions affects the percentage yield of the extracts. *Ficus benjamin* of fruits, leaves and bark contains various bioactive components like stigma sterol, quercetin, cinnamic acid, and lactose naringenin [36].

2. History/Origin

Ficus benjamina is found in Asia, Australia, and pacific region. The species is reportedly unusual at the Marshall Islands, with just one tree found developing close to a village. This plant has been growing on Earth for an exceptionally prolonged time and fossil remains have been located as 30 million years old. Its common English name 'weeping fig' refers to its drooping branches as well as its aerial roots which descend from the branches to the ground [37].

3. Demography/Location

Ficus benjamina can grow in moderate amount of water during the warm season and requires only small amount of the water enough to shield it from drying out during the rest of the year. Total figure for weeping fig generation are hard to get. However, the world production of crude fig in 2013 was 1.1 million tones, led by Turkey with 0.3 million tones. The estimated production of other countries was as follow: Egypt 0.15 million ton, Algeria 0.12 million ton and Iran 0.08 million ton [38].

4. Botany/Morphology/Ecology

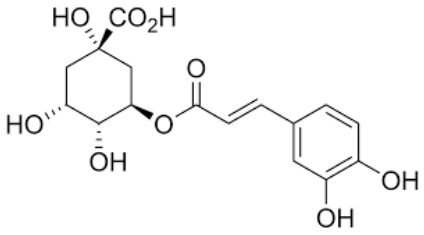
Ficus benjamina is one of the most popular houseplants. Shiny oval leaves can be categorized into following classes depending on the species; plain green, creamy yellow, marked with burgundy, green, yellow or pink, and silver-white patterns. *F. benjamina* plant is available as natural looking bush, however; it also grows on trunks that can be twisted, straighten or interwoven. Generally, branches droop slightly by providing it a graceful green appearance. Leaves are oblong ovate, leathery, 6-9 cm long, having noticeable and somewhat slender point, rounded base. Petioles are 5-10 mm long while fruit is solitary, axillary, dark-purple, stalk less and fleshy when mature, rather spherical and 1 cm in diameter [39].

5. Chemistry

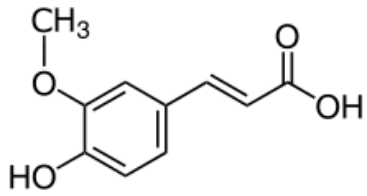
Banyan is traditionally known for flavonoids. Banyan tree have diverse compounds in various parts of plant [40].

5.1. Chemical composition

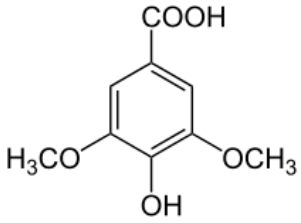
Weeping fig contains little amount of fatty oil and have less calorific value. *Ficus benjamina* demonstrated the presence of phenolics, carbohydrates, saponins, flavonoids, alkaloids, proteins, and tannins. Chlorogenic, ferulic and syringic acids are present in root. Chlorogenic, p-coumaric, and ferulic acids are present in stems, and leaves contains caffeic acid (Figure 1.) [23].



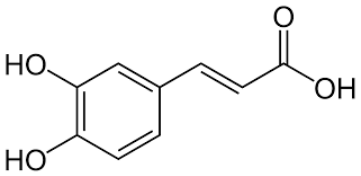
Chlorogenic acid



Ferulic acid



Syringic acid

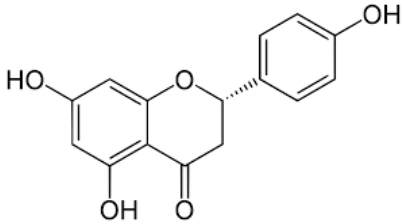


Caffeic acid

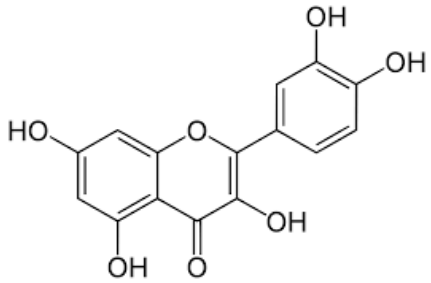
Figure 1: Fatty acids present in weeping fig.

5.2. Phytochemistry

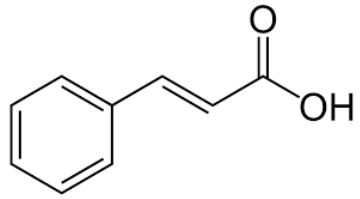
Ficus benjamina has specific aromatic odor because of the existence of essential or volatile oil [1-16], which is largely confined in green leaves. These oils are generally characterized by gas chromatography mass spectrometry (GC-MS) analysis [41-46]. This scented volatile oil from leaves is chiefly comprised of alkaloids, saponins, flavonoids and tannins [47-49]. The oil extracted from seeds is mainly composed of naringenin, quercetin and cinnamic acid (Figure 2). The leaf oil of *Ficus benjamina* collected during the day, contained high contents of alpha-pinene, abietadiene, cis-alpha-bisabolene, reticuline, calycanthidine, anabasine, tomatidine, acridine derivative, sophocarpine, neblinine, harmine, obscurinervinediol, ergoline, ellipticine, indicine, matridine, scoulerine, hydroxyl morphine, aspidospermidine, nicodicodine, adenocarpine, lycocernuine, isoclaurine, dasycarpidan, retronecine, and clemastine [50].



Naringenin



Quercetin



Cinnamic acid

Figure 2: Compounds present in the weeping fig seed oil

6. Post-harvest technology

Conventionally, the best harvesting time of *Ficus benjamina* is early in the morning, just after the evaporation of dew before the day temperature start increasing. It has been observed that the essential oil activity is strong in the morning. Main method of this plant storage is air-layering method. Weeping fig is stored for a week or less [51]. Weeping fig should be dried under shade instead of sun drying otherwise it will lose aroma due to essential oil volatility [52-53].

7. Processing

Ficus benjamina, like other natural plant, is consumed in a variety of methods and for numerous purposes. In addition to its fresh leaves, other common processed kinds of weeping fig encompass entire dry leaves, powdered leaves, and extracted essential oils. Fresh and mature leaves of *F. benjamina* are collected and washed very well with water before drying (room temperature). Leaves needed to be dried straight away after harvest as they darken if left uncovered in open air for prolonged period. Dried leaves of weeping fig can be stored for 12 months when saved blanketed from warmth, mild and moisture [54].

8. Value addition

Different parts of weeping fig are used in various medicines after careful processing.

9. Uses

Ficus benjamina and other spices contribute significantly for the ornamental purpose. Latex of this plant is toxic and should be kept away from children. Twigs can be used to control insects in field. Leaf juice can be used as bug and flea repellant. Latex can be applied on the boils as this plant has number of anti-oxidants. Free radicals are responsible for the several clinical disorders like cancer, diabetes mellitus, degenerative disease, renal failures as they disturb the natural defense mechanisms. However, natural anti-oxidants present in the body provides defense against these diseases. It is well known now that plant extracts strengthen the anti-oxidant defense system of human. *Ficus benjamina* is used in several important medicines. It is used in medicine for malaria, influenza, dysentery, airways inflammation (bronchitis), acute enteritis, whooping cough (pertussis) and hot seizures in children [55].

9.1. General therapeutic uses

Ficus benjamina has various uses ranging from culinary to religious; its uses are often high in ritual. There are a number of curious beliefs associated with the historical uses of weeping fig. The presence of various types of alkaloids in *Ficus* species is responsible for the potent biological activities like, anti-oxidant, anti-cancer, anti-microbial and anti-muscarinic activities [56].

9.2. Pharmacological uses

F. benjamina has showed potent anti-oxidant activities. Methanolic extracts of *F. benjamina* also showed cytotoxic activities in brine shrimp lethality assay. Phytochemical screening of methanolic extract of *F. benjamina* confirmed the presence of excessive levels of phenolics (4.006 mg gallic acid equivalence/gm) and flavonoids (16.005 mg quercetin acid equivalence/gm) compounds responsible for its anti-oxidant activity. The study of Ficus spp. shows the presence of numerous compounds including alkaloids, triterpenes, ascorbic acid, and flavonoids [57].

9.2.1. Anti-bacterial activity

Essentials oils obtained from various plants generally showed good anti-microbial activity [58-59]. Anti-bacterial effect of plant extract was observed on various bacterial species *Escherichia coli*, *Staphylococcus aureus*, *Klebesiella pneumonia*, *Pseudomonas aeruginosa* and *Salmonella typhi* [60].

9.2.2. Anti-oxidant activity

F. benjamina exhibits strong anti-oxidant activity in various assays [61]. The root and leaves showed good anti-oxidant activity, whereas stem extract and fractions revealed good anti-microbial activity [23].

9.2.3. Hemolytic activity

Ficus benjamina stem, leaves and root demonstrates strong hemolytic actions [62].

9.2.4. Anti-fungal activity

Ficus benjamina has shown strong activity to inhibit *Aspergillus niger* (ATCC 10595) [63].

9.2.5. Insect repellent activity

Ficus benjamina twigs are used as insect repellant by keeping them under the beds. Its leaves have some active compounds that repel the insects. It is also used to repel the insect from kitchen and other places.

9.2.6. Pollution removal activity

Ficus benjamina tree leaves have ability to depollute the contaminated environments.

9.2.7. Anthelmintic activity

It showed anthelmintic activity against grown-up Indian night crawler *Pheretima posthumous*. *Ficus benjamina* activity was dose dependent [63].

10. Summary

Ficus benjamina, commonly known as "weeping fig", "benjamin fig" or "ficus tree", and often sold in stores as just "ficus", is a species of flowering plant in the family Moraceae, native to Asia and Australia. The genus Ficus belongs to Moraceae family growing in tropical and subtropical areas and includes more than 800 species. *F. benjamina* L., is a medium size tree with a few spreading branches from the base usually called "sobbing fig". *F. benjamina* activities are due to presence of cinnamic acids, lactose, naringenin, quercetin, caffeic acid and stigma sterol.

References

[1] U. Hayat, M.I. Jilani, R. Rehman, F. Nadeem. (2015). A Review on *Eucalyptus globulus*: A New Perspective in Therapeutics. International Journal of Chemical and Biochemical Sciences. 8: 85-91.

[2] S. Jabeen, Z.M.H. Al Mahruqi, F. Nadeem, T. Khalid. (2017). Bitter Apple (*Citrullus colocynthis*)-A Review of a Wild Plant Growing from Asia to Africa with High Medicinal Potentials. International Journal of Chemical and Biochemical Sciences. 11: 65-70.

[3] A. Khalil, H. Nawaz, J.B. Ghania, R. Rehman, F. Nadeem. (2015). Value Added Products, Chemical Constituents and Medicinal Uses of Celery (*Apium graveolens* L.)–A Review. International Journal of Chemical and Biochemical Sciences. 8: 40-48.

[4] S. Kousar, F. Nadeem, O. Khan, A. Shahzadi. (2017). Chemical Synthesis of Various Limonene Derivatives–A Comprehensive Review. International Journal of Chemical and Biochemical Sciences. 11: 102-112.

[5] R.A.K. Muqaddas, F. Nadeem, M.I. Jilani. (2016). Essential Chemical Constituents and Medicinal Uses of Marjoram (*Origanum majorana* L.)–A Comprehensive Review. International Journal of Chemical and Biochemical Sciences. 9: 56-62.

[6] R.A.K. Muqaddas, A. Tahir, F. Nadeem. (2018). Historical Origin, Chemical Constituents and Therapeutic Potentials of Sanatha (*Dodonaea viscose*)–A Brief Review. International Journal of Chemical and Biochemical Sciences. 14: 48-54.

[7] F. Nadeem, M.W. Azeem, M.I. Jilani. (2017). Isolation of Bioactive Compounds from Essential Oils–A Comprehensive Review. International Journal of Chemical and Biochemical Sciences. 12: 75-85.

[8] N. Naeem, F. Nadeem, M.W. Azeem, R. Dharmadasa. (2017). *Tamarindus indica*–A Review of Explored Potentials. International Journal of Chemical and Biochemical Sciences. 12: 98-106.

[9] A. Nawaz, M.A. Ayub, F. Nadeem, J.N. Al-Sabahi. (2016). Lantana (*Lantana camara*): A Medicinal Plant Having High Therapeutic Potentials–A Comprehensive Review. International Journal of Chemical and Biochemical Sciences. 10: 52-59.

[10] S. Naz, F. Nadeem, Z.M.H. Al Mahruqi, S. Inam. (2015). Medicinal Uses and Bioactivities of Ginger–A Detailed Review. International Journal of Chemical and Biochemical Sciences. 8: 71-77.

[11] S. Naz, M. Rezgui, R. Rehman, F. Nadeem. (2015). Pomegranate an Ancient Seed for Modern Cure–A Review of Potential Applications. International Journal of Chemical and Biochemical Sciences. 8: 78-84.

[12] R. Rehman, D. Melki, A. Shehzad, F. Nadeem, T. Khalid. (2018). Commercial Importance, Medicinal Value and Therapeutic Potentials of Chaff Flower (*Achyranthes aspera*)–A Review. International Journal of Chemical and Biochemical Sciences. 14: 62-70.

[13] A. Shehzad, A. Qayyum, R. Rehman, F. Nadeem, M. Raffi. (2018). A Review of Bioactivity Guided Medicinal Uses and Therapeutic Potentials of Noxious Weed (*Alternanthera sessilis*). International Journal of Chemical and Biochemical Sciences. 14: 95-103.

[14] H.N. Sobia, S. Khan, F. Nadeem. (2018). Use of Malabar Nut (*Justicia adhatoda* L.) from Traditional Medicine to Current Pharmacopeia–A Review Study. International Journal of Chemical and Biochemical Sciences. 13: 46-51.

[15] A. Tahir, M.I. Jilani, R.A. Khera, F. Nadeem. (2016). *Juniperus communis*: Biological Activities and Therapeutic Potentials of a Medicinal Plant–A Comprehensive Study. International Journal of Chemical and Biochemical Sciences. 9: 85-91.

[16] Z. Zahid, S. Khan, F. Nadeem, M.W. Azeem. (2015). The Review of Power of Poppy: Harnessing Benefits of Nature's Most Dangerous Plant. International Scientific Organization. 8: 56-64.

[17] E.F. Gilman, D.G. Watson. (1993). *Ficus benjamina* Weeping Fig. FactSheet ST-251. USA.

[18] R.V. Illán, J.M. Crespo, J.O. Rego, M.J.S. Blanco, S.B. Arias. (2012). Saline reclaimed wastewater can be used to produce potted weeping fig (*Ficus benjamina* L.) with minimal effects on plant quality. Spanish journal of agricultural research. (4): 1167-1175.

[19] V. Lysenko. (2012). Fluorescence kinetic parameters and cyclic electron transport in guard cell chloroplasts of chlorophyll-deficient leaf tissues from variegated weeping fig (*Ficus benjamina* L.). Planta. 235(5): 1023-1033.

[20] M. Shirzad, S. Sedaghathoor, D. Hashemabadi. (2012). Effect of media and different concentrations of IBA on rooting of *Ficus Benjamina* L.' cutting.

[21] R. Bercu. (2013). Biometrical observations on *Ficus benjamina* L. 'Starlight' leaves. Annals of the Romanian Society for Cell Biology. 18(1): 217.

[22] H. Babaie, H. Zarei, K. Hemmati. (2014). Propagation of *Ficus benjamina* var. Starlight by Stenting Technique under Different Concentration of IBA in Various Time of Taking Cutting. Journal of Ornamental Plants. 4(2): 75-79.

[23] M. Imran, N. Rasool, K. Rizwan, M. Zubair, M. Riaz, M. Zia-Ul-Haq, U.A. Rana, A. Nafady, H.Z. Jaafar. (2014). Chemical composition and Biological studies of *Ficus benjamina*. Chemistry central journal. 8(1): 12.

[24] M. Aeini, H. Mirzaee, S.M. Taghavi, G.R. Khodakaramian, M.A. Mazhar. (2014). Occurrence of crown gall disease on *Ficus benjamina* in Fars and Isfahan provinces of Iran. Archives of Phytopathology and Plant Protection. 47(18): 2257-2262.

[25] L. Yarmolinsky, M. Huleihel, M. Zaccai, S. Ben-Shabat. (2012). Potent antiviral flavone glycosides from *Ficus benjamina* leaves. Fitoterapia. 83(2): 362-367.

[26] A. Singh, J.S. Brar. (2016). First record of *Trilocha Varians* (Family: Bombycidae) A Pest of *Ficus Benjamina* (L.) and its biology in Talwandi Sabo, Dist Bathinda, Punjab. Bulletin of Entomology. 43: 669-672.

[27] M. Zimmermann, A. Wardrop, P. Tomlinson. (1968). Tension wood in aerial roots of *Ficus benjamina* L. Wood Science and Technology. 2(2): 95-104.

[28] N. Kumar, S. Khurana. (2015). New plant disease record in Panchgaon: Fig rust (*Cerotelium fici* (Castagne) Arthur) on *Ficus benjamina* L. Inter. J. Current Microbiol. Appl. Sci. 4: 749-754.

[29] D. Scuderi, F. Giuffrida, S. Toscano, D. Romano. (2012). Growth, physiological response, and quality characteristics of weeping fig in response to shading levels and climatic conditions. HortScience. 47(11): 1586-1592.

[30] S.K. Dara, D.R. Hodel. (2015). Weeping fig thrips (Thysanoptera: Phlaeothripidae) in California and a review of its biology and management options. Journal of Integrated Pest Management. 6(1): 2.

[31] M.M. Navasero, M.V. Navasero. (2014). Biology of Trilocha varians (Walker) (Lepidoptera: Bombycidae) on *Ficus benjamina* L. In the Philippines. The Philippine Entomologist. 28(1).

[32] S. Dara, Weeping fig thrips, Gynaikothrips uzeli, found in California. In 2014.

[33] G. Bauer, T. Speck. (2012). Restoration of tensile strength in bark samples of *Ficus benjamina* due to coagulation of latex during fast self-healing of fissures. Annals of botany. 109(4): 807-811.

[34] A. Bircher, S. Langauer, F. Levy, R. Wahl. (1995). The allergen of *Ficus benjamina* in house dust. Clinical & Experimental Allergy. 25(3): 228-233.

[35] I. Axelsson, S. Johansson, P. Larsson, O. Zetterström. (1991). Serum reactivity to other indoor ficus plants in patients with allergy to weeping fig (*Ficus benjamina*). Allergy. 46(2): 92-98.

[36] H.A.A. Dafalla, M. Rahmani, M.A. Sukari, A.M. Ali. (2003). The chemical constituents of *Ficus benjamina* Linn. and their biological activities. Pertanika Journal of Science & Technology. 11(1): 73-81.

[37] S. Michie, J. Brown, A.W. Geraghty, S. Miller, L. Yardley, B. Gardner, L. Shahab, A. McEwen, J.A. Stapleton, R. West. (2012). Development of Stop Advisor. Translational behavioral medicine. 2(3): 263-275.

[38] R.D. Harrison. (2005). Figs and the diversity of tropical rainforests. Bioscience. 55(12): 1053-1064.

[39] W. Graves, R. Gladon. (1985). Water stress, endogenous ethylene, and *Ficus benjamina* leaf abscission. HortScience (USA).

[40] A. Bulle. en M. de Jongh, 2001b. Effects of growing conditions on the shelf life of *Ficus benjamina*. Acta Horticulturae. 543: 113-117.

[41] I. Ahmad, M.A. Hanif, R. Nadeem, M.S. Jamil, M.S. Zafar. (2008). Nutritive evaluation of medicinal plants being used as condiments in South Asian Region. Journal of the Chemical Society of Pakistan. 30(3): 400-405.

[42] A.Y. Al-Maskri, M.A. Hanif, M.Y. Al-Maskari, A.S. Abraham, J.N. Al-sabahi, O. Al-Mantheri. (2011). Essential oil from *Ocimum basilicum* (Omani Basil): a desert crop. Natural product communications. 6(10): 1934578X1100601020.

[43] M.A. Hanif, M.Y. Al-Maskari, A. Al-Maskari, A. Al-Shukaili, A.Y. Al-Maskari, J.N. Al-Sabahi. (2011). Essential oil composition, antimicrobial and antioxidant activities of unexplored Omani basil. Journal of Medicinal Plants Research. 5(5): 751-757.

[44] E.M. Abdallah, A.E. Khalid. (2012). A preliminary evaluation of the antibacterial effects of *Commiphora molmol* and *Boswellia papyrifera* oleo-gum resins vapor. International Journal of Chemical and Biochemical Sciences. 1: 1-15.

[45] I. Shahzadi, R. Nadeem, M.A. Hanif, S. Mumtaz, M.I. Jilani, S. Nisar. Chemistry and biosynthesis pathways of plant oleoresins: Important drug sources.

[46] M.A. Hanif, A.Y. Al-Maskri, Z.M.H. Al-Mahruqi, J.N. Al-Sabahi, A. Al-Azkawi, M.Y. Al-Maskari. (2011). Analytical evaluation of three wild growing Omani medicinal plants. Natural product communications. 6(10): 1934578X1100601010.

[47] I. Batool, S. Nisar, L. Hamrouni, M.I. Jilani. (2018). Extraction, Production and Analysis Techniques for Menthol: A review. International

Journal of Chemical and Biochemical Sciences. 14: 71-76.

[48] M.A. Hanif, S. Nisar, G.S. Khan, Z. Mushtaq, M. Zubair, Essential Oils. In *Essential Oil Research*, Springer: 2019; pp 3-17.

[49] M. Naz, S. Nisar, A. El Zerey-Belaskri, A. Umer, M. Idrees. (2018). Synthesis and Uses of various essential oil based derivatives in biomedicine. International Journal of Chemical and Biochemical Sciences. 13: 92-99.

[50] M.Z. Salem, A. Salem, L. Camacho, H.M. Ali. (2013). Antimicrobial activities and phytochemical composition of extracts of Ficus species: An over view. African Journal of Microbiology Research. 7(33): 4207-4219.

[51] B. Vargas, L. Molina. (2012). *Ficus benjamina* L. in the cities: high number of individuals, severe damages to infrastructure and expensive economic losses. Revista Nodo. 7(13).

[52] Z. Zahid, M. Rezgui, S. Nisar, M.W. Azeem. (2016). Phytochemistry and medicinal uses of underutilized tree *Garcinia indica*: A detailed review. International Journal of Chemical and Biochemical Sciences. 10: 40-45.

[53] I. Ibrahim, T. Nasr-El-Din, B. Mohamed, A. Arafa. (1992). Rapid multiplication of *Ficus benjamina* using tissue culture technique. Egyptian Journal of Agricultural Research (Egypt).

[54] K. Steinkamp, C. Conover, R. Poole. (1991). Acclimatization of *Ficus benjamina*: a review. Notes. 17(9): 1-5.

[55] S. Hasti, E. Mora, R. Utami, L.U. Yulis. (2014). Sub-chronic Toxicity of *Ficus Benjamina* L. Leaves Ethanol Extract on the Liver Function of White Mice. Procedia Chemistry. 13: 204-208.

[56] A.M. Omer, T.M. Tamer, M.A. Hassan, M.M. Sabet, M.S.M. Eldin. International Journal of Pharmacy.

[57] V.K. Kanaujia, H. Rirchhaiya, S. Kailasiya, M. Verma, R. Yadav, D. Shivhare. (2011). Evaluation of hepatoprotective activity on the leaves of *Ficus benjamina* Linn. J Nat Prod Plant. 1: 59-69.

[58] M.A. Hanif, H.N. Bhatti, M.S. Jamil, R.S. Anjum, A. Jamil, M.M. Khan. (2010). Antibacterial and antifungal activities of essential oils extracted from medicinal plants using CO_2 supercritical fluid extraction technology. Asian Journal of Chemistry. 22(10): 7787.

[59] M.M. Khan, M. Iqbal, M.A. Hanif, M.S. Mahmood, S.A. Naqvi, M. Shahid, M.J. Jaskani. (2012). Antioxidant and antipathogenic activities of citrus peel oils. Journal of Essential Oil Bearing Plants. 15(6): 972-979.

[60] P. Dhungana, P. Devi, S. Borthakur. (2013). International Journal of Pharmacy and Life Sciences. Int. J. of Pharm. & Life Sci. (IJPLS). 4(1): 2314-2319.

[61] A. Jain, V. Ojha, G. Kumar, L. Karthik, K.V.B. Rao. (2013). Phytochemical composition and antioxidant activity of methanolic extract of *Ficus benjamina* (moraceae) leaves. Research Journal of Pharmacy and Technology. 6(11): 1184-1189.

[62] R. Patel, P. Gautam. Medicinal Chemistry & Analysis.

[63] S. Guettaf, N. Abidli, S. Kariche, L. Bellebcir, H. Bouriche. (2016). World Journal of Pharmaceutical Research.