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Review

Phyto-pharmacological wonders of genus *Ficus*: Ethnopharmacological insights and phytochemical treasures from natural products

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ABSTRACT

Natural products have perennially served as a cornerstone for the genesis of novel medicinal compounds. Most clinical therapeutics originate from ancestral herbal remedies and their formulations. Scholars and practitioners have always aimed to extract better remedies to treat various ailments. Genus *Ficus*, consisting of over 800 varieties, is a substantial tree native to tropical regions, characterized by its deciduous or evergreen nature. Various parts of this plant, including its bark, roots, leaves, fruit, and latex, find extensive use in treating a multitude of ailments. This review aims to update the ethnopharmacology, chemistry, and potential clinical applications of extracts and active ingredients from the ten most prevalent *Ficus* species. Major databases like Chemical Abstracts, ScienceDirect, SciFinder, PubMed, Scopus, etc. have all been used to generate references for this review. According to a thorough review of the literature, the many species of *Ficus* have a wide range of biological properties, including antioxidant, cytotoxic, antibacterial, antiviral, antifungal, anti-inflammatory, antiallergenic, antiasthmatic, larvicidal, antiplasmodial, antidiabetic, hepatoprotective and cardioprotective activity. A bunch of different secondary metabolites, such as flavonoids, saponins, alkaloids, tannins, phenolic acids, phytosterols, etc., were also reported, which can be responsible for exerted medicinal actions as well as play a crucial role in the field of new drug discovery and development. However, most species are missing well-controlled and double-blind clinical investigations. Thus, we still recommend further extensive exploration of this miraculous genus.

1. Introduction

Since the beginning of humans, plants have been the most abundant source of a wide variety of exquisite medications, and they continue to provide any form of unique remedies (Taher et al., 2024; Obonti et al., 2021). As per the World Health Organization, approximately 70 to 80 percent of the global population, particularly in developing countries, depend on herbal medicine as their primary form of treatment (Chan, 2003; Hasnat et al., 2024). Nutraceuticals are foods artificially altered to improve their nutritional value or medicinal properties; herbal medicines, on the other hand, result from centuries of traditional medicine practiced by Indigenous peoples. The first documented proof of their utilization can be traced back approximately 5000 years in Indian, Chinese, Egyptian, Greek, Roman, and Syrian texts. Notably, ancient Indian scripts such as Rigveda, Atherveda, and Sushruta Samhita contain references to their use (Kamboj, 2000; Shompa et al., 2024; Taher et al., 2023; 1003.). Although synthetic medications found in the market can efficiently treat ailments, they frequently come with adverse

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side effects. On the other hand, plant-based medications are increasingly acknowledged for their powerful therapeutic advantages and reduced negative responses. Therefore, there is a growing recognition that natural plant-derived compounds are a valuable and robust source of new, safe, and effective secondary bioactive metabolites with therapeutic promise (Zaman et al., 2023; Islam et al., 2022). Presently, there is a heightened focus on the investigation of plants, and a substantial amount of data has been gathered to showcase the vast scope of medicinal herbs used in various traditional methods. The majority of biodynamic compounds with therapeutic value come from medicinal plants; however, it's incredible how many different kinds of plants exist that have various therapeutic benefits (Harsha et al., 2002).

Among the family Moraceae, the genus *Ficus* contains the greatest variety, with forty genera and over eight hundred species of trees, shrubs, lianas, and numerous varieties (Fig. 1) (Patel and Gautam, 2014; Mahomoodally et al., 2019). The genus is primarily native to subtropical and tropical regions (Ahmad et al., 2013). A noteworthy genetic diversity among different varieties of *Ficus* species contains significant pharmacological activities and commercial importance. They are, therefore, one of the first plants to be grown for human consumption, having been farmed for more than 1100 years (Ahmad et al., 2013). The ten most common *Ficus* species, namely, *Ficus auriculata, Ficus benghalensis, Ficus benjamina, Ficus carica, Ficus deltoidea, Ficus exasperata, Ficus microcarpa, Ficus racemosa, Ficus religiosa,* and *Ficus sycomorus* have been selected for review on their botanical, ethnopharmacological, phytochemicals and pharmacological aspect. The authors of this paper want to draw attention to the untapped potential of the *Ficus* species among natural product researchers worldwide. As a consequence of the fact that promising species can be utilized in the treatment of medical conditions, this genus really needs extensive research.

2. Methodology

The methodology entailed doing a methodical exploration across prominent scientific databases, including Chemical Abstracts, Science Direct, Scopus, SciFinder, and PubMed. Relevant papers were retrieved using keywords such as "*Ficus auriculata,*" "*Ficus benghalensis,*" "*Ficus benjamina,*" "*Ficus carica,*" "*Ficus deltoidea,*" "*Ficus exasperata,*" "*Ficus microcarpa,*" "*Ficus racemosa,*" "*Ficus religiosa,*" "*Ficus sycomorus,*" "biological properties," "isolated compounds", "phytochemicals", "ethnopharmacology", "botany", "distribution", "antioxidant," "cytotoxicity," "antibacterial," "antiviral," "antifungal," "anti-inflammatory," "antiallergenic," "antiasthmatic," "larvicidal," and "antiplasmodial," "antidiabetic," "cardioprotective", "hepatoprotective". The inclusion criteria encompassed experimental investigations on the biological features of *Ficus* species, regardless of publication date or language, and included both *in vitro* and *in vivo* research, while *in silico* works were excluded. Only papers that are peer-reviewed and written in English are considered for this review. The synthesis of the gathered data yielded a complete picture of the wide range of biological activity demonstrated by different species of *Ficus*.

3. Botany

An evergreen tree with a crown that is both elongated and broad, *Ficus auriculata* can grow to a height of between 4 and 10 m. They have greyish-brown bark with an unpleasant texture, and their central stem branchlets are leafless, which can be 1–1.5 cm thick; they also have a rosy brown colour (El-Fishawy et al., 2012). Leaves of *F. auriculata* are huge (length $\times$ width of the lamina $\geq$ 580 cm^2), substituting, with a broadly ovate-cordate shape, an entire edge that is shallowly dentate, and a summit that is obtuse-muscronate (El-Fishawy et al., 2012; Wei et al., 2014). Peduncles are broad as well as 4–6 cm tall with pubescent

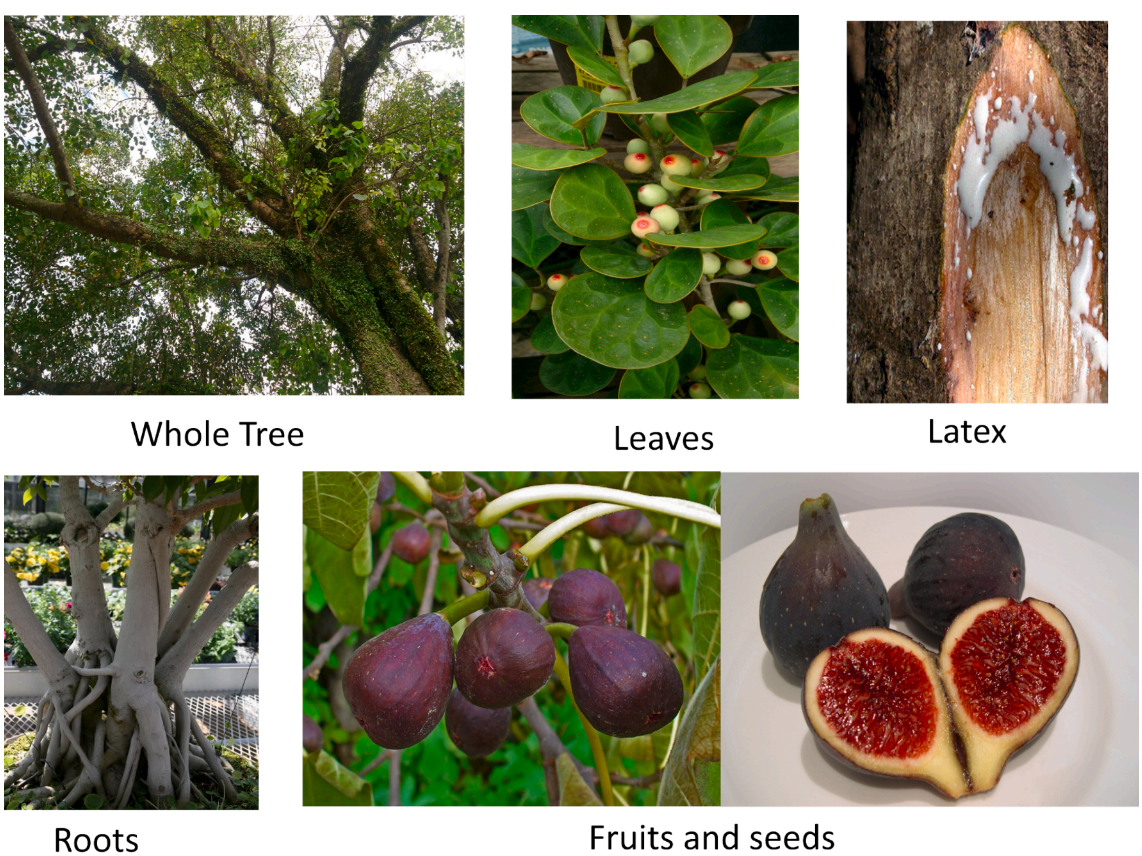

Fig. 1. Some *Ficus* species and the different plant parts (Plants, 2023).

(Shilpakar, 2009). August to March is the period of blossom, and May to August is the period of fruiting (Shilpakar, 2009).

Ficus benghalensis, the Indian banyan tree, is a laticiferous, moraceaeous, gigantic evergreen tree that generally grows 23–34 m tall, with colossal spreading appendages backed by airborne roots which afterward shape adornment trunks expanding to a vast zone and hefty, delicately pubescent branchlets (Patel and Gautam, 2014; Talukdar et al., 2015 Jan 10). Its bark is greenish white, where leaves are primary, interchange, and regularly organized in clusters at the closes of branches along with 5–12 cm wide and 10–18 cm long stipulate with whole, broadly elliptic to praise (Abdul, 2017). Blossoms are diminutive, unisexual, and almost 3 sorts such as males, females, and imperfect females are swarmed in conjunction with bracteoles within the internal dividers of meaty receptacles which are sessile, globose, almost 1.8 cm diameter, puberulous, emerging in axillary sets, orbicular, spreading (Patel and Gautam, 2014), likewise, these fruits are achenes, and they're little, crustaceous, and enclosed in those typical meaty pods that have a reddish-brown skin (Abdul, 2017).

Ficus benjamina, also known as the Weeping fig or Benjamina fig, is a yearly, evergreen, hemi-epiphytic, woody tree (Mahomoodally et al., 2019; Veneklaas et al., 2002); It is one of the most beautiful and smooth figs. As the tree grows, its spread is generally broader than its height, with a thick umbrella-like cover of pendant branches that reach the ground (Starr et al., 2003). Benjamin fig cross-pollinates exceptionally effortlessly, the coming about differences and variety has found, for fertilization wasps play an imperative part in the propagation of this species so that individuals of this class are difficult to distinguish by their blooms, but can be recognized by their design, whether they are sobbing fig or not, by leaf shape, and by their natural products (Mahomoodally et al., 2019). It has adventitious, every so often drooping root; gray and trouble-free bark; brown, glabrous branchlets; elliptical, elliptic, lanceolate, or praise about weathered, adjusted base or cuneate and summit acuminate or cuspidate leaf blade; both surface and glabrous adaxially; single, axillary, dark-purple, stalkless and meaty natural products (Starr et al., 2003; Mahomoodally MF, Asif F, Shafaq RRAI. A review of the pharmacological potential and phytochemical profile of Weeping Fig-Ficus benjamina L. ., 2019).

Ficus carica, commonly known as the Common Fig or Anjeer, is a monoecious, deciduous large shrub. It typically grows to a height of 6.9 to 10 m. As one of the oldest cultivated fruits in the Mediterranean region, it produces two crops each year. The first crop, known as fig flowers, appears in spring, followed by the main harvest of figs in summer and autumn (Ahmad et al., 2013; Baraket et al., 2009). It has various spreading branches, but the trunk seldom develops to a distance across more noteworthy than 7 in.; non-adventitious roots; marginally roughened, cylindrical and greyish or pale dark colored bark; pubescent branchlets, simple palmate, blade obovate, ovate, and thick leaves which are profoundly separated into 3 to 7 primary projections and harsh on the upper surface but delicate and bushy on the underside (Starr et al., 2003; McGovern, 2002; Rashid et al., 2017). The fruits of the common fig are a syconium, in other words, a fleshy hollow repository with a contract gap at the tip, obovoid, turbinate, or pear-shaped, more often than not develops 1 to 4 in. long and changes in colour from yellowish-green to coppery, bronze, or dim purple (McGovern, 2002; Rashid et al., 2017).

Ficus deltoidea got its name from the distinctive golden spots on its leaves. It is also known by various other names, including Mistletoe Fig, Mas Cotek, Telinga Beruk, Sarawak, Kalimantan Island, and Tabat Barito. This shrub can reach a height of six feet and is categorized into male and female plants. The primary difference between the two is that male plants have elongated leaves, while female plants have large, round leaves (Ramamurthy et al., 2014; Rosnah et al., 2015). Commonly, it contains different molded leaves such as lanceolate, spatulate, and obovate shapes and is named the "Mistletoe elastic tree" since it oozes natural rubber from its steam part (Ramamurthy et al., 2014). Again, it is an evergreen bush with whitish-grey bark; slender and, more often than not, leaning trunk; spherical to rounded fruits with a width of 1.0—1.5 cm and colored yellow to orange-red (Bunawan et al., 2014; 2014.; Starr et al., 2003). Warmth and humidity cherish the plant and produce pleasant airborne roots beneath such conditions (Starr et al., 2003).

Ficus exasperata, also known as *Ficus asperrima* Roxb, *Ficus hispidissima*, *Ficus politoria* Moon, *Ficus punctifera* Warb., *Ficus scabra* Willd. but most commonly known as "sandpaper", is an evergreen, terrestrial, deciduous, auxiliary timberland habituated tree that develops within the drier sorts of timberland or in rocky places and, in some cases, enduring in cleared land could grow approximately 20 m in stature, contains smooth grey bark which oozed a gummy sap (Amponsah et al., 2013; Mouho et al., 2018). Leaves of *Ficus exasperata* are distichous, substitute, ovate to elliptic, sub-coriaceous to coriaceous, pinnacle shortly acuminate, base intense to harsh, upper surface scabrous having an unpleasant surface, making them seem like sandpaper and hence the title, sandpaper tree. Sandpaper contains three to five sets of sidelong veins; branches that are basal paired and coming to at or over the center of the lamina; fruits which are sublogus, hispidulous peduncle, for the most part, come to 1 to 2.5 cm width and usually show up in sets within the leaf axils (Ahmed et al., 2012).

Ficus microcarpa is a broadly planted, greatly tough, but is touchy to ice and well-known decorative tree commonly known as Chinese banyan, Indian tree, shrub fig, window ornament fig, Malay banyan, small-fruited fig or glossy-leaved fig 33. However, the Curtain fig is an evergreen tree that comes to 15 m (50ft) or more in tallness, with an adjusted thick crown, smooth grey bark, milky sap, and long, lean, dangling ethereal roots (Ravichandra and Paarakh, 2011). Leaves of the fig are alternate; basic, weathered, profound reflexive green, oval-elliptic to diamond-shaped, up to 13 cm long, with brief pointed, furrowed tips, in the interim blooms are little, unisexual, various, covered up inside the "fig" which may be a plump, specialized repository that creates a different natural product also called syconium (Ravichandra and Paarakh, 2011; Chan et al., 2017). Again, the species title, "*microcarpa*" alludes to the small measure of the fig, since syconia of *F. microcarpa* are little, axillary, develop separately or in sets at leaf axils, degree approximately 6–10 mm in breadth, and turn from pinkish to reddish-green, purplish or dark when ripe (Riefner, 2016; Ravichandra and Paarakh, 2011).

Ficus racemosa or *Ficus glomerata* may be an evergreen, moderate to huge measured spreading, lactiferous, deciduous avenue plan that develops 20 m tall frequently and is ordinarily known as the Cluster Fig tree, Indian Fig tree or Gular Fig tree (Bhalerao and Ethenomedicinal, 2014). The tree is without arial root, not at all like its numerous family individuals and contains leaves that are notched minutely shaggy, lamina ovate-lanceolate to elliptic-lanceolate, tri-ribbed, 8–10 sets of sidelong sets from comprehensive to barely cuneate, diagonal base, entirely margined, acuminate at the summit, glabrous on both sides, stipules triangular-ovate, brown, sub-persistent, cystoliths show as it were on the lower side and they are shed by December and renewed by January and April, when, the tree gets to be uncovered for a brief period (Bhalerao and Ethenomedicinal, 2014; Paarakh, 2009). The fruits are repositories 2–5 cm in breadth, pyriform in massive clusters, emerging from the fundamental trunk or huge branches, take after the figs and are green when crude, turning orange, gloomy ruddy or dull dark red on maturing where the seeds are modest, multitudinous, grain like and the external surface of the bark is infirmly complex and non-brittle, comprises of effectively detachable translucent chips greyish to corroded brown (Joseph and Raj, 2010).

Ficus religiosa could be a long life expectancy tree with a normal life extending between 900 and 1,500 years and is cultivated by forte tree plant nurseries for utilization as a decorative tree in gardens and parks and tropical and subtropical climates since it is an expansive perpetual tree, moreover, the tree is glabrous when youthful, semi-evergreen and reached up to 98 ft tall and a trunk of approximately 9.8 ft, as well as the tree is sacrosanct in both Hinduism and Buddhism that's why named *'religiosa'* which suggests 'religion' (Bhalerao and Ethenomedicinal, 2014; Sharma et al., 2019). The tree gets to be crown wide when developed and contains grey, smooth, or longitudinally fissured bark; greyish brown, scantily pubescent (when youthful) branchlets; triangular-ovate rough, abaxially green, adaxially dull green and glossy, broadly based cuneate to cordate, whole or undulate edged, intense to caudate pinnacled leaf edge with two basal horizontal veins and two auxiliary veins (Al-Snafi, 2017). Ordinarily, the interchange leaves of *F. religiosa* are heart-shaped and glossy with an exquisite tail-like tip, which is frequently called a "drip-tip", directing water effectively down to the soil, which avoids now and then overwhelming storm rain from collecting on the leaves for delayed periods and may make them hot in a hot climate (Bhalerao and Ethenomedicinal, 2014). The fruits are small; compared to that of the eye pupil, in paired, 1–1.5 cm in breadth, green color when crude, and turn dark when ripe; besides, the natural products show up in summer and mature by stormy season; moreover, the little, rosy, unisexual blossoms show up in pairs within the points of the leaves on the twigs at February, positioning as axillary sessile with morphologically recognized as male and female (Bhalerao and Ethenomedicinal, 2014; Sharma et al., 2019).

Ficus sycomorus, locally known as Gemez may be a tropical and subtropical plant species that accomplish up to a tallness of 20 m and now and then comes to 6 m in width, with a thick circular crown of broadly spreading branches and a gigantic crown, whereas leaves are heart-shaped, profound green with a circular pinnacle and 14 cm long by 10 cm wide and the development rate is decently quick at 1–1.5 m/year in frost-free regions (Kassa et al., 2015; Osama and Awdelkarim, 2015). Once more, *F. sycomorus* may be a thick-branched, wide-spreading tree called a shade plant, Tin in Middle Easterner, and Dumor in Bangladesh. Besides, it contains a natural product with a round shape, which contains high nutritive esteem; furthermore, the natural products are green and are around 2 to 3 cm in breadth, turning yellow or ruddy when they ripen. Likewise, the natural product species contain a few hundred to thousands of seeds and are exceptionally delicious; now and then, the bark is green, but other times, it is yellow with white latex (Abbafati et al., 2020).

4. Taxonomic Classification

This genus is part of the plant kingdom and falls under the species Tracheophyta, which means it possesses vascular tissues to transport water and nutrients. Belonging to the class Magnoliopsida and subclass Dilleniidae, it is classified under Urticales and the family Moraceae, demonstrating its close evolutionary connection to nettles and mulberries. This plant is classified within the Moraceae family, specifically in the tribe Ficeae and the genus *Ficus*, indicating its association with fig species (Sandeep et al., 2018).

5. Distribution

According to the Global Biodiversity Information Facility (GBIF), species under the genus '*Ficus*' are broadly distributed throughout almost all the world's continents, namely, North America, South America, Africa, Asia, Europe and Oceania. Among them, Asia holds the most number of species whereas Europe has the least. The global distribution of the genus '*Ficus*' is demonstrated in Fig. 2 (Facility, 2024).

F. auriculata is broadly conveyed in Pakistan, North India, Nepal, Bhutan, Myanmar, both South and West China, Laos, Cambodia, Indochina, Thailand, Vietnam, and Peninsular Malaysia (Zhang et al., 2018, 2019).

F. benghalensis is a huge evergreen tree local to dry districts of equatorial nations, such as South Asia (India, Sri Lanka, Pakistan, Bangladesh) and the Southern and Eastern portion of Nigeria, it usually develops from low altitudes to 2000 ft or 610 m (B.D Arimah OPO. Phytochemical analysis and comparison of in-vitro antimicrobial activities of the leaf, stem bark and root bark of {Ficus} benghalensis. IOSR J Pharm [Internet]., 2013; Patel and Gautam, 2014; Talukdar et al., 2015).

F. benjamina is a colossal, spreading, strangulation tree local to a huge region counting India, Southern China, Southeast Asia, Malaysia, Philippines, Northern Australia, and the islands of the South Pacific. However, it is neutralized to the Galapagos Islands, Australia, USA, Bangkok and Thailand (Starr et al., 2003; Khan et al., 2019).

F. carica is likely a local of South-west Asia that quickly spread to the Mediterranean region (Egypt) by humans not less than 6000 years ago (McGovern, 2002). However, it conceivably began from the Middle East,

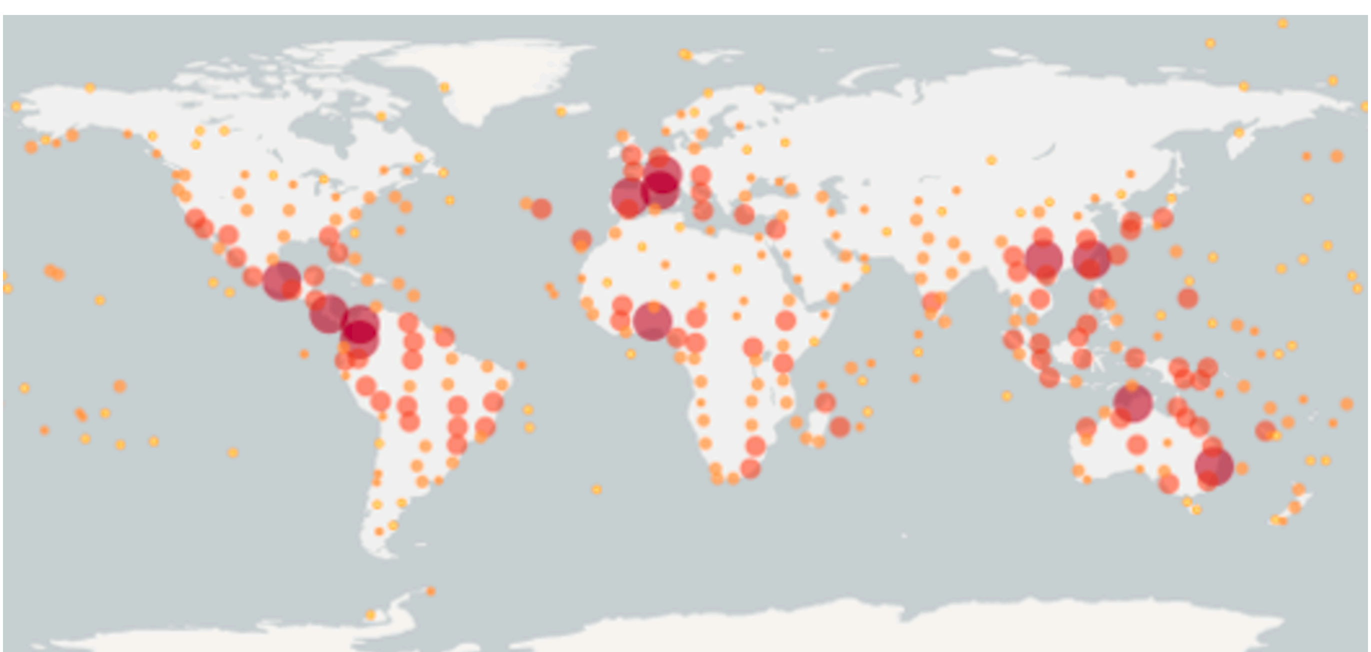

Fig. 2. Distribution of *Ficus* species throughout the world.

cultivated as a fruit species, and grown in several regions of southern and northwestern India (Rashid et al., 2017). In addition, it can develop among rocks, woods, hot weather, as well as on dry soils, and in the present world, it was first planted by Mexican people in 1560 (McGovern, 2002).

F. deltoidea is local and broadly disseminated through Southeast Asian countries to Borneo (such as Malaysia, Thailand, Sumatra, Java, Kalimantan, Sulawesi, and Moluccas) and the Philippines (Starr et al., 2003; Fatihah et al., 2014). However, the species can develop sandy and bushy regions to mountain tops and in a marsh with a stature up to 1200 m latitude (Rosnah et al., 2015).

F. exasperata, more often than not, develops within the drier sorts of timberland, auxiliary vegetation, rocky places, and, in some cases, enduring in cleared land at altitude up to 2000 m from sea level. However, it broadly disseminated in tropical Africa, from Senegal and Ethiopia to Mozambique, Zambia, and northern Angola and expanding within the southern portion of the Middle Eastern Landmass (Yemen), India and Sri Lanka (IK et al., 2013; Ahmed et al., 2012).

F. microcarpa is indigenous from Sri Lanka, to southern China, Japan, Australia, and Modern Caledonia, commonly found in coastal zones and topographically disseminated from South, Southeast, and East Asia through Australia and the Pacific Islands (Chan et al., 2017; Lin et al., 2008). In addition, it could be a well-known fancy tree, more often than not developed in numerous warm temperate, subtropical, and tropical districts of the world, hence naturalized in Los Angeles, Orange, Riverside, San Diego, Wander provinces, and Southern California (Riefner, 2016).

F. racemosa is local to Australia, Southeast Asia, and the Indian subcontinent, hence disseminated from external Himalayan ranges, Punjab, Khasia mountain, Chota Nagpur, Bihar, Orissa, West Bengal, Rajasthan, Deccan and South India to all over India (Paarakh, 2009; Shiksharthi and Mittal, 2011). It is ordinarily found in numerous timberlands and slopes of India, as well as, develops in evergreen and deciduous woodlands, moist territories, and banks of streams, all through the year, for maximum tallness of 1800 m above sea level (Paarakh, 2009; Joseph and Raj, 2010) It is frequently planted around the domestic and temples, since it is part of the four sacrosanct trees of Nalpamara (Ksirivrksas). Also it is cultivated for shades and fruits (Paarakh, 2009).

F. religiosa, despite being known as an aboriginal Indian tree, is generally local to the Asian tropical ranges, including Bangladesh, India, Nepal, Pakistan, China, Myanmar, Thailand, Vietnam, and Iraq. It mainly originated in Northern and Eastern India (Bhalerao and Ethenomedicinal, 2014; Al-Snafi, 2017). Additionally, it is broadly planted in numerous hot nations, especially in Buddhist nations and all over the world, from South Africa to Hawaii and Florida. It often develops up to 1650 m or 5000 ft above sea level in mountain zones (Bhalerao and Ethenomedicinal, 2014).

F. sycomorus is local to the Middle East, South West Africa, Egypt, Ethiopia, Israel, Kenya, Cape Verde Islands, Namibia, and the Comoro Islands. But it broadly conveyed to the regions with a maximum elevation up to 2000 m above sea level and mean yearly rainfall ranging from 500 to 1800 mm per year but a maximum of 2200 mm per year, including Zambia, Zimbabwe, Syrian Arab Republic, Cote d'Ivoire, Uganda, Swaziland, Djibouti, Tanzania, Nigeria, Angola, Sudan, Benin, Botswana, Burundi, Cameroon, Congo, Equitable Republic of Congo, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Lesotho, Madagascar, Mozambique, Rwanda, Saudi Arabia, Senegal and Somalia (Kassa et al., 2015; Erhirhie et al., 2018). Again, the species develops thoroughly in profound, well-drained soil to clay-type soil or Sandy soils with shallow groundwater, and with mean yearly temperature extending from 0 °C to 40 °C (Kassa et al., 2015).

6. Chemical compounds

Table 1 demonstrates that only a few species from the existing species of *Ficus* genus have been studied, and most of them were collected from Asian, African, and Middle East countries. As an exception, only *F. carica* was collected from two European countries including Italy and Northeast Portugal. Despite all other plant parts, leaves and fruits are the most studied parts of those species. However, sun-dried fruits of *F. carica* and essential leaf oil of *F. exasperata* and *F. religiosa* have also been studied. Eventually, seeds and resin are the less studied plant parts; in particular, seeds of *F. bengalensis* and resin of *F. carica* have only been studied. Moreover, roots, aerial roots, and bark, as well as both root bark, stem, and stem bark, have also been studied.

Various chemicals, especially flavonoids, terpenes, sterols, and organic acids, have been isolated from those species by different methods. In particular, the most common flavonoids are catechin and rutin. Similarly, linalool, α-pinene, and lupeol are the most common terpenes; β-sitosterol and stigmasterol are common sterols and palmitic acid is a common organic acid.

In most cases, more than one compound was identified from various plant parts, in contrast, a single compound isolated from the root and stem of *Ficus auriculata*, leaves of *Ficus benjamina* in the Pakistani sample, the bark of *F. benjamina* in the Malaysian sample and ripe fruits of *F. racemose*. Again, almost the same volatile constituents are isolated from *F. deltoidea, Ficus microcarpa, and Ficus religiosa*. In addition, the most significant number of compounds were isolated from *F. sycomorus* and a few were isolated from *F. auriculata*.

Different types of chromatographic, spectroscopic, and NMR methods have been used to identify various compounds. Indeed, a chromatographic method like SGCC, VLC, TLC, HPLC, PC, etc., spectroscopic methods like UV–Vis, IR, HR-ESI-MS, HR-FAB-MS, etc., and NMR methods like CNMR, HNMR, COSY, NOESY, ROSEY, HMBC, HSQC etc. along with combined analysis methods like GS-MS, LC-MS, GC-EMIS and other analysis methods like XRD, PDA, SPME, DEPT and DAD are together used for identified various constituents from various plant parts. In six cases, the GS-MS technique was only used for isolation; in two cases, GS-MS along with HPLC was used for identification, and in three cases, GS-MS with two other chromatographic methods, including GC and CC, was used to identify volatile constituents from fruits of F. deltoidea, F. macrocarpa*, and Ficus religiosa.*

7. Ethno-pharmacology

This review delves into the ethnopharmacological uses of different species from the *Ficus* genus. Table 2 summarizes these results by providing a synopsis of the pharmacological characteristics and uses of several *Ficus* species. Juice of stem barks of *F. auriculata* is a folk remedy in Nepal ordinarily used to treat loose bowels, dysentery, cuts, and wounds (Shilpakar, 2009). Moreover, its smashed or paste leaves are used to treat wounds, loose bowels, and dysentery. In addition, latex is utilized as an anthelmintic and healing cuts, wounds, and caries, besides the root-latex of the species used to treat mumps, cholera, loose bowels, and vomiting (Saklani and Chandra, 2012).

According to Charaka, *F. benghalensis* or Nyagrodha leaf buds and airborne roots blend with honey and sugar to treat loose bowels, vomiting, thirst, and fevers with burning sensation; in hemorrhages and bleeding piles, it is airborne roots and leaf bud handled with milk utilized for treatment; besides, leaf bud endorsed for promoting conception, blood purifier in skin maladies, urinary and urinogenital disorders (Abbafati et al., 2020; Murti et al., 2010). Ordinarily; fruits, airborne roots, bark, and leaves as well as entire trees are traditionally related to diarrhea, dysentery, menorrhagia, anxious, and tonic properties; but, concurring to Ayurveda it is primarily utilized for the treatment of diabetes (Verma et al., 2015). In addition, decoction or extraction of leaves, sap milk, fruits, or wood is utilized to treat influenza, diarrhea, fuel, and decoction (Zahoor et al., 2017). Specifically, traditionally, roots that are carried in the air are useful in cases of osteomalacia of the limbs, leucorrhoea, hyperpiesia, diabetes, enuresis, ulcers, skin diseases, gonorrhea, hyperpiesia, hyperpiesis, hemorrhages, diarrhea, dysentery,

Table 1
List of phytocompounds identified from various species of *Ficus*.

Species	Collection site	Organs	Compounds	Techniques	Reference
Ficus auriculata	Orman Garden, Giza, Egypt.	Leaves and Fruits	Betulinic acid	TLC, VLC, SGCC, IR, EI-MS, HNMR, CNMR, UV–Vis	(El-Fishawy et al., 2011)
			Lupeol		
			Stigmasterol		
			Bergapten		
			7-Hydroxy-6-methoxy coumarin		
			β-Sitosterol-3-O-β-D-glucoside		
			Myricetin		
			Quercetin 3-O-β-D-glucopyranoside		
	Hainan Province, China	Root	5,7,4′-Trihydroxy-3′-hydroxymethyl-isoflavone	SGCC,IR,CNMR,Sp-HPLC,HR-ESI-MS, TLC,DEPT, HSQC,HMBC,^{1}H–^{1}H COSY, ROESY	(Qi et al., 2018)
		Stem	*Ficus*ine D	HR-ESI-MS, CNMR, HNMR, IR, DEPT, ^{1}H–^{1}H COSY, ROESY,HMBC	(Shao et al., 2018)
Ficus bengalensis	New Delhi	Bark	Lanost-5,24-dien-3β-yl-β-D-glucopyranosid-2′-O-yl-docos-11″-enoate	IR,CNMR,HNMR,HMBC,^{1}H–^{1}H COSY,DEPT	(Naquvi et al., 2015)
			3β-Acetoxy-stigmast-22-en-26-oic acid		
	Khartoum-North	Leaves	Catechin	IR,CNMR,HNMR,HMBC,^{1}H–^{1}H COSY,MS,UV,TLC	(Almahy and Alhassan, 2011)
			Genistein		
	India	Seeds	12, 13- Epoxy-octadec-*cis*-9-enoic acid	UV,FTIR,HNMR,MS,TLC,GLC	(Hosamani and Pattanashettar, 2003)
			7-(2-Octacyclopropen-1-yl)heptanoic acid		
			8-(2-Octacyclopropen-1-yl)octanoic acid		
			Lauric acid		
			Myristic acid		
			Palmitic acid		
			Stearic acid		
			Oleic acid		
			Linoleic acid		
			Linolenic acid		
			Vernolic acid		
			Malvalic acid		
			Sterculic acid		
Ficus benjamina	Faisalabad, Pakistan	Leaves	Caffeic acid	GS-MS,HPLC	(Imran et al., 2014)
		Stem	Chlorogenic		
			p-Coumaric		
			Ferulic acids		
			2-Pentanone		
			Hexadecanoic acid		
			Palmitic acid		
			9,12-Octadecadienoic acid		
		Bark	Chlorogenic		
			p-Coumaric		
			Ferulic acids		
			Syringic acids		
		Root	Hexadecanoic acid		
			Palmitic acid		
			9,12-Octadecadienoic acid		
			Methanamine		
			methyl-2 Phenylindole		
			Cyclopentanone		
			Cyclopropaneoctanal		
			Arsenous acid		
	Ojo, Nigeria	Leaves	α-Pinene	GC-EIMS,GC	(Ogunwande et al., 2012)
			Abietadiene		
			Cis-α-bisabolene		
			Germacrene-D-4-ol		
			1,10-di-epi-cubenol		
			Hexahydrofarnesylacetone		

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Table 1 (*continued*)

Species	Collection site	Organs	Compounds	Techniques	Reference
	Cameroon	Root and Bark	β-Amyrin acetate β-Amyrin Psoralen Betulinic acid Lupeol Platanic acid β-Sitosterol glucoside Benjaminamide Benjaminadine Methyl 2-hydroxytetracosanoate Sphingosine	HNMR,CNMR,HMQC,HMBC,COSY, CGTLC,VLC, HREIMS	(Simo et al., 2008)
	Malaysia	Leaves	Cinnamic acid Lactose Naringenin 3,5,7,3′,4′-Pentahydroxyflavone 3,4-dihydroxy cinnamic acid	CC,TLC,HNMR,CNMR,DEPT,MS,IR,UV	(Almahy et al., 2003)
		Bark	Stigmasterol		
		Leaves	Quercetin 3-O-rutinoside Kaempferol 3-O-rutinoside kaempferol 3-O-robinobioside	HNMR,CNMR,HPLC,LC-ESI-MS,HR-MS	(Yarmolinsky et al., 2012)
Ficus carica	Bisignano, Cosenza, Italy	Sun dried Fruits	Nonanal 2-Decenal (E) 2,4-Dodecadienal (E,E) Tetradecanal Pentadecanal Octadecanal Nonadecanal Pentadecanoic acid Methyl palmitate Palmitic acid Myristic acid Ethyl heptadecanoate Methyl linoleate Methyl linolenate Ethyl palmitate Methyl stearate Stearic acid Linoleic acid Ethyl linoleate Ethyl linolenate Methyl arachidate Ethyl stearate Campesterol Stigmasterol Stigmasta-5,23-dien-3-ol β-Sitosterol Aristolone Viminalol Oleanan-12-en-3-ol Oleanan-12-en-3-ol acetate Dammaradienyl acetate	UV–Vis,GS,GS-MS,SPME	(Loizzo et al., 2014)
	Mirandela region, Northeast Portugal	Leaves	3-O-caffeoylquinic acid 5-O-caffeoylquinic acid Ferulic acid Quercetin 3-O-glucoside Quercetin 3-O-rutinoside	HPLC,DAD	(Oliveira et al., 2009 Nov)

(*continued on next page*)

Table 1 (*continued*)

Species	Collection site	Organs	Compounds	Techniques	Reference
			Psoralen		
			Bergapten		
			Oxalic acid	HPLC,UV–Vis	
			Citric acid		
			Malic acid		
			Quinic acid		
			Shikimic acid		
			Fumaric acid		
	Israel	Resin	6-O-acyl-β-D-glucosyl-β-sitosterols	SGCC,TLC,GC–MS,HNMR,CNMR,HPLC	(Rubnov et al., 2001)
			Palmitoyl		
			Linoleyl		
			Stearyl		
			Oleyl		
		Leaves	Quercetin	HPLC,LC-MS,UV–Vis	(Vaya and Mahmood, 2006)
			Luteolin		
			Biochanina		
Ficus deltoidea	Brunei	Fruits	4-Methylbenzaldehyde	GC,GC-MC,CC	(Grison-Pigé et al., 2002)
			Methyl benzoate		
			Indole		
			Decanal		
			6-Methyl-5-hepten-2-One		
			Myrcene		
			(Z)-β-Ocimene		
			(E)-β-Ocimene		
			cis-furanoid Linalool oxide		
			trans-furanoid Linalool oxide		
			Linalool		
			cis-Pyranoid linalool oxide		
			trans-Pyranoid linalool oxide		
			Limonene		
			Dendrolasine		
			α-Cubebene		
			Cyclosativene		
			α-Ylangene		
			α-Copaene		
			β-Bourbonene		
			1,5-diepi-β-Bourbonene		
			β-Cubebene		
			β-Elemene		
			α-Gurjunene		
			α-*cis*-Bergamotene		
			β-Caryophyllene		
			α-Santalene		
			Selina-3,6-diene		
			cda-trans Bergamotene		
			α-Humulene		
			Alloaromadendrene		
			Aciphyllene		
			Germacrene		
			β-Selinene		
			δd-Selinene		
			α-Selinene		
			Bicyclogermacrene		
			α-Muurolene		
			Germacrene A		
			δ-Amorphene		

(*continued on next page*)

Table 1 (*continued*)

Species	Collection site	Organs	Compounds	Techniques	Reference
			δ-Cadinene		
			(E,E)-α-Farnesene		
			2-epi-α-Selinene		
			δ-Cadinene		
			Cadina-1,4-diene		
			Germacrene B		
			Caryophyllene oxide		
	Malaysia	Dried Leaves	Gallocatechin	MS,HPLC,PDA	(Omar et al., 2011)
			Catechin		
			(epi)Afzelechin-(epi)catechin		
			(epi)Afzelechin-(epi)afzelechin-(epi)catechin		
			Epicatechin		
			Luteolin-6,8-C-diglucoside (lucenin-2)		
			Apigenin-6,8-C-diglucoside (vicenin-2)		
			Luteolin-6-C-hexosyl-8-C-pentoside		
			Luteolin-6-C-glucosyl-8-C-arabinoside		
			Apigenin-6-C-arabinosyl-8-C-glucoside (isoschaftoside)		
			Luteolin-6-C-arabinosyl-8-C-glucoside		
			Apigenin-6-C-glucoside-8-C-arabinoside (schaftoside)		
			Luteolin-8-C-glucoside (orientin)		
			Apigenin-6-C-pentosyl-8-C-glucoside		
			4-*p*-Coumarolyquinic acid		
			Apigenin-8-C-glucoside (vitexin)		
			Apigenin-6-C-glucosyl-8-C-pentoside		
			Apigenin-6,8-C-dipentoside isomer		
			Apigenin-6-C-glucoside (isovitexin)		
		Leaf	Phenol	GS-MS	(Seong Wei et al., 2011)
			2,4-bis (Dimethylbenzyl)-6-t-butylphenol		
			Cyanogen		
			Octaethylene glycol		
			Octaethylene glycol monododecyl ether		
			Phthalic acid		
			2-Pentadecanone, 6, 10, 14-trimethyl		
			Carbonic acid		
			1,4,7,10,13,16-Hexaoxacyclooctadecane		
			Hexagol		
			Butanoic acid		
			1H-Indene, 2,3-dihydro-1,1,3-trime		
			15-Crown-5, [2-(diethylboryl) pheny]-		
			4-Amino-2, 6-dimethyl-3-pyridyl 1-adamantanecarboxylate		
			Hexadecanoic acid, methyl ester		
			2-Methoxybenzoic acid, cyclopenthyl ester		
			Heptadecanoic acid, 16- methyl-, methyl ester		
			1-Propoxy-3,3-diethyltriazene 2-oxide		
			Heptacosane		
Ficus exasperata	East Cameroon	Stem bark	(2S,3S,4R,11E)-2-[(2′,3′-Dihydroxyhexacosanoylamino)]-11-octadecene-1,3,4-triol	SGCC,HR-ESI-MS, HNMR, CNMR, FTIR, COSY, HSQC, HMBC	(Dongfack et al., 2012)
			(−) Oxypeucedanin hydrate		
			(+) Oxypeucedanin hydrate		
			Bergapten		
			Stigmasterol		
			Sitosterol glucopyranoside		
			Sitosterol		
			3,7-Dioxofriedelane		
			5-Methoxydurimillone		
			2,3-Dihydroxypropylpalmitate		

(*continued on next page*)

Table 1 (*continued*)

Species	Collection site	Organs	Compounds	Techniques	Reference
	Ogun State, Nigeria	volatile leaf oil	α-Pinene p-Cymene 1, 8-Cineole β-Caryophyllene α-Ionone Neryl acetone β-Ionone Caryophyllene oxide 6,10,14-Trimethyl-2-pentadecanone 9-Octadecenoic acid Cyclooctasulfur $^{+}$ (E)-Phytol	GS-MS	(Sonibare et al., 2006)
	Ilorin	Root bark	α-Terpineol α-Pinene Sabinene β-Pinene 1,8-Cineole Limonene Linalool (E)-β-Ocimene β-Patchoulene α-Thujopsene β-Bisabolene α-Copaene Alloromadendrene β-Caryophyllene Isocaryophyllene Globulol	GS-MS	(Oladosu et al., 2009)
	Littoral region of Cameroon	Roots	3′-(2-Hydroxymethyl-7-methoxy-2-methyl-2H-6-chromenyl)-(E)-propenoic acid 3-(6-Methoxybenzo[b]furan-5-yl) propenoic acid Bergapten Oxypeucedanin hydrate Marmesin Decursinol Aridanin Betulinic acid Maslinic acid Stigmasterol β-Sitosterol Sitosteryl-3-O-β-D-glucopyranoside	HNMR, CNMR, DEPT, COSY, HSQC HMBC, HR-ESI-MS, UV, IR	(Tameye et al., 2020)
Ficus microcarpa	Okinawa, Japan	Bark	Protocatechuic acid Chlorogenic acid Methyl chlorogenate Catechin Epicatechin Procyanidin B1 Procyanidin B3	HPLC, ESI-MS, UV, HNMR, CNMR, HMBC, COSY, HMQC	(Ao et al., 2010)
	Taipei, Taiwan	Leaves	15^{1}(S)-Methoxypurpurin-7-lactone-15^{1}-methoxy-15^{2},17^{3}-dimethyl ester 15^{1}(S)-Methoxypurpurin-7-lactone-15^{1}-methoxy-15^{2}-methyl-17^{3}-phytyl ester 7-Oxoaristophyll-C Aristophyll-C Pyropheophytin a 13^{2}(S)-Pheophyton a	TLC, CC, HPLC, HR-FAB-MS, MS, IR, UV–Vis, HNMR, CNMR, DEPT, HMBC, NOESY	(Lin et al., 2011)

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Table 1 (*continued*)

Species	Collection site	Organs	Compounds	Techniques	Reference
			13^{2}(R)-Pheophyton a		
			13^{2}(R)-Hydroxypheophytin a		
			13^{2}(S)-Hydroxypheophytin a		
			13^{2}(R)-Hydroxypheophyton a		
			13^{2}(S)-Hydroxypheophyton a		
	Taipei	Aerial Roots	2′,7-Epoxy-syringoylglycerol 8-O-β-D-glucopyranoside	SGCC,SGDCC, HR-FAB-MS, FAB-MS, HNMR, CNMR, DEPT, NOESY, UV–Vis	(Ouyang and Kuo, 2006)
			(7S,8R)-Syringoylglycerol		
			(7S,8R)-Syringoylglycerol-7-O-β-D-glucopyranoside		
			(7E,9Z)-Dihydrophaseic acid 3-O-β-D-glucopyranoside		
			Icariside D2		
			2,7-dimethyl-3,6-dihydroxyl-1,8-di-octanoic acid		
			2,2′-dihydroxyl ether		
			2′,7-Epoxy-guaiacylglycerol 8-O-β-D-glucopyranoside	SGCC, HR-FAB-MS,FAB-MS, HNMR, CNMR, HMBC, NOESY, UV–Vis	(Ouyang et al., 2007)
			Guaiacylglycerol		
			Erythro-guaiacylglycerol		
			Guaiacylglycerol 9-O-β-D-glucopyranoside		
			Erythroguaiacylglycerol 9-O-β-D-glucopyranoside		
			4-Methoxy guaiacylglycerol 7-O-β-D-glucopyranoside		
			3-(4–hydroxy–3–methoxyphenyl)propan-1,2-diol		
	Brunei	Fruits	4-Methylbenzaldehyde	GC,GC-MC,CC	(Shivasharanappa and Londonkar, 2014)
			Methyl salicylate		
			Myrcene		
			(E)-β-Ocimene		
			Linalool		
			α-Pinene		
			Sabinene		
			β-Pinen		
			Limonene		
			α-Cubebene		
			Junipene		
			α-Copaene		
			β-Cubebene		
			β-Elemene		
			β-Caryophyllene		
			β-Copaene		
			Aromadendrene		
			α-Humulene		
			Germacrene D		
			bicyclogermacrene		
			α-Muurolene		
			Germacrene A		
			δ-Cadinene		
Ficus racemosa	Gulbarga University Campus	Ripe Fruits	Dihydroxy myricetin [3,5 dihydroperoxy-7-hydroxyl-2- (3,4,5-trihydroxyphenyl)-4H-chromen-4-one]	FTIR, MS, TLC, MS, HNMR, CNMR	(Jain et al., 2013)
	Jaipur, Rajasthan,India	Root Bark	n-Hexacosane	SGCC, TLC, IR, HNMR, CNMR	(Jain et al., 2013)
			Polypodatetraene		
			α-Amyrin acetate		
			Gluanol acetate		
			Lupeol acetate		
			β-Amyrin acetate		
			Bergenin		
			24,25-Dihydroparkeol acetate		
			Lanost-20-en-3β-acetate		
			α-Amyrin octacosanoate		
			β-Sitosterol		
			β-Sitosterol-β-D-glucoside		

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Table 1 (*continued*)

Species	Collection site	Organs	Compounds	Techniques	Reference
Ficus religiosa	Brunei	Fruits	Undecane Tridecane Tetradecane (Z)-3-Hexenol 1-Hexanol (Z)-3-Hexenyl acetate (Z)-cdb-Ocimene (E)-β-Ocimene Perillene α-Pinene Camphene β-Pinene α-Terpinene Limonene α-cubebene α-ylangene α-copaene β-bourbonene β-Caryophyllene α-trans Bergamotene Aromadendrene α-Humulene Alloaromadendrene Germacrene D Bicyclogermacrene γ-Cadinene δ-Cadinene	GC,GC-MC,CC	(Grison-Pigé et al., 2002)
	Nepal	Leaf essential oil	(3Z)-Hexenol (2Z)-Hexenol n-Hexanol Phenol Adipoin 3-Methylcyclopenetane-1,2-dione Itaconic anhydride Benzyl alcohol Salicylaldehyde Phenylacetaldehyde Allyl caproate Linalool n-Nonanal 2-Phenylethyl alcohol Benzeneacetonitrile (2E,6Z)-Nonadienal (2E)-Nonen-1-ol (2E,6Z)-Nonadienol (E)-Linalool oxide Catechol Coumaran (E)-Cinnamyl alcohol *p*-Vinylguaiacol (3Z)-Hexenyl tiglate Eugenol (2E)-Hexenyl (3Z)-hexenoate (E)-β-Ionone Dihydroactinidiolide α-Copaene-11-ol	GS-MS	(Poudel et al., 2015)

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Table 1 (*continued*)

Species	Collection site	Organs	Compounds	Techniques	Reference
			(3Z)-Hexenyl benzoate		
			epi-γ-Eudesmol		
			γ-Eudesmol		
			epi-α-Cadinol		
			β-Eudesmol		
			α-Eudesmol		
			α-Cadinol		
			Pentadecanal		
			Palmitic acid		
			Phytol		
	Kurukshetra	Fruits	n-Hexadecanoic acid		(Goyal, 2014)
			Hexadecanoic acid, ethyl ester		
			9,12-Octadecadienoic acid		
			9,12,15-Octadecatrienoic acid		
			Octadecanoic acid		
			Butyl 9,12,15-octadecatrienoate		
Ficus sycomorus	Giza, Egypt	Fruits	Quinol	HPLC, GS-MS	(El-Beltagi et al., 2019)
			Gallic acid		
			Catechol		
			Caffeine		
			Vanillic acid		
			Syringic acid		
			Caffeic acid		
			Vanillin		
			p-Coumaric acid		
			Ferulic acid		
			Benzoic acid		
			Rutin		
			o- Coumaric acid		
			Salicylic acid		
			Myricetin		
			Cinnamic acid		
			Quercitin		
			Neringenin		
			Rosmarinic acid		
			Kaempferol		
			Ambrosiol (8,9-dihydroxy-6,9a-dimethyl-3-methylidene-decahydro-azuleno[4,5-b]furan-2(3 h)-one)		
			N-Methyl-2-chloropyrrole		
			4-Amino-3,5-di-2-pyridyl-4H-1,2,4-triazole		
			2-Methylpyrrole-3-carbonitrile		
			1,4-Cyclohexanedione		
			2-Isopropyl-1,3-dioxolane		
			Phenyltrihydrosilane		
			Ethanone, 1-(2-methyl-1-cyclopenten-1-yl)		
			Methyl ester of gibberellin A5		
			Benzene, 1,4-dimethyl-2,5-bis (1-methylethyl)		
			2,4-Di-*tert*-butylphenol		
			Phenyl 4-[bis(ethoxycarbonyl)but-3-ynyl]-2,3,4-trideoxy-.alpha.,Lglcero-pent-2-		
		Leaves	Pyrogallol		
			Gallic acid		
			Catechol		
			p-Hydroxy benzoic acid		
			Caffeine		
			Chlorgenic acid		
			Vanillic acid		

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Table 1 (*continued*)

Species	Collection site	Organs	Compounds	Techniques	Reference
			Syringic acid Caffeic acid Vanillin p-Coumaric acid Ferulic acid Benzoic acid Rutin Ellagic acid Salicylic acid Myricetin Cinnamic acid Neringenin Rosmarinic acid Kaempferol Gamma-Undecalactone 2-Ethylcyclohexyl 3-chloropropanoate 2-Ethylcyclohexyl bromoacetate Aspidocarpine 5-(1-Hydroxy-2-propanyl)-2-methylcyclohexanol 2,7-Anhydro-l-galacto-heptulofuranose 1,5-Naphthalenediol Thiosulfuric Acid Quinic acid α-D-Glucopyranoside de α-D-glucopyranosyl-(1->3)-β-D-fructofuranosyle, hydrate O-Benzyl-L-serine 4-Allyl-2,6-dimethoxyphenol [1,1′-Bicyclopropyl]-2-octanoic acid, 2′-hexyl-, methyl ester Nalidixic Acid D-chiro-Inositol, 3-O-(2-amino-4-((carboxyiminomethyl)amino)-2,3,4,6-tetradeoxy- Neo Inositols Psoralene Phytol, acetate 6-(3-Hydroxy-but-1-enyl)-1,5,5-trimethyl-7-oxabicyclo[4.1.0]heptan-2-ol Methyl Palmitate Palmitic Acid Methyl (11E,14E)-octadeca-11,14-dienoate Methyl Linolenate Phytol Methyl isostearate Linoleoyl chloride *cis*-5,8,11,14,17-Eicosapentaenoic acid Quercetin 7,3′,4′-Trimethoxy Lupeol		
	Aboutouala, Mania El-kamh province, Sharkia governorate, Egypt	Leaves	N-ethyl-1, 3 dithioisoindoline 3-hexen-1-ol, (Z) Benzene methanol L- linalool	GS-MS	(Romeh, 2013)

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Table 1 (*continued*)

Species	Collection site	Organs	Compounds	Techniques	Reference
			1-methylbicyclo [4.1.0] heptanes 1-methylnorcarane)		
			salicylic acid methyl ester		
			1, 3- cyclohexadiene-1-carboxaldehyde, 2, 6, 6-trimethyl		
			1-cyclohexene- 1- carboxaldehyde		
			Alpha- ionone		
			3- buten- 2-one, 4-(2,6,6-trimethyl-1-cyclohexen-1-yl)		
			Pentadecane		
			Cycloheptasiloxane,tetradecamethyl		
			2(4H) – benzofuranone, 5, 6, 7, 7a-tetrahydro-4, 4,7a-trimethyl		
			3-hexen-1- ol, benzoate, (Z)		
			Megastigmatrienone		
			3- hexadecene, (Z)		
			Methyl jasmonate		
			Silane		
			4- (3, 4-dimethoxybenzylidene) – 1- -3-phenyl-2-pyrzolin 5-one – 3-phenyl –2-pyrazoline- 5-one		
			2- pentadecanone		
			Hexadecanoic acid, methyl ester		
			n-Hexadecanoic acid		
			Z, Z-3, 13- octadecadien-1-ol		
			9- octadecenoic acid (Z), methyl ester (methyl oleate)		
			oleic acid		
			1H –pyrazole, 4-nitro		
			palmetoyl chloride		
			cyclohexene		
			5- heptadecenal		
			piperidine		
			Hexanedioic acid		
			9- octadecenoic acid (Z)- 2-hydroxy-1-(hydroxymethyl) ethyl ester		
			1, 2-benzenedicarboxilic acid, diisooctyl ester		
	El-Qualubia Governorate	Leaves	quercetin	SGCC, PC, TLC, UV–Vis, HNMR, CNMR, ESI-MS	(El-Sayed et al., 2010)
			gallic acid (3, 4, 5-trihydroxybenzoic acid)		
			quercetin-3-*O*-α-L-rhamnopyronosyl (1 → 6) β-D-glucopyranoside		
			quercetin-3-*O*-β-D-glucopyranoside		
			quercetin 3, 7-*O*-α-L-dirhamnoside.		
			quercetin-3-O-β-D-galactopyranosyl (1 → 6) glucopyranoside.		
			β-Sitosterol-3-O- β-D-glucopyranoside.		

VLC = Vacuum liquid chromatography; SGCC = Silica Gel Column chromatography; SGDCC = Silica Gel Dry Column Chromatography; PC = Paper Chromatography; TLC = Thin Layer Chromatography; HPLC = High-performance Liquid Chromatography; Sp-HPLC = Semi preparative High-performance Liquid Chromatography; HR-ESI-MS = High-resolution electrospray ionisation mass spectrometry; GC–MS = Gas Chromatography Mass Spectrometry; LC–MS = Liquid chromatography–mass spectrometry; GC-EIMS = Gas chromatography-electron ionization mass spectrometry; HR-FAB-MS = High resolution fast atom bombardment mass spectrometry; UV–Vis = Ultraviolet–visible spectroscopy; IR = Infrared spectroscopy; FTIR = Fourier-transform infrared spectroscopy; 1H–1H COSY = Correlation Spectroscopy; NOESY = Nuclear Overhauser enhancement exchange spectroscopy; HMBC = Heteronuclear Multiple Bond Correlation Spectroscopy; ROESY = Rotating Frame Overhauser Enhancement Spectroscopy; HSQC = Heteronuclear single quantum coherence spectroscopy; XRD = X-ray diffraction analysis; DEPT = Distortionless enhancement by polarization transfer; SPME = Solid Phase Microextraction; DAD = Diode Array Detector; PDA = Photodiode Array Absorbance;

Table 2
Ethnophramacological utilization of different species of *Ficus* genus.

Species	Plant part	Utilization	Reference
Ficus auriculata	Stem Bark	treat loose bowels, dysentery, cuts and wounds	(Shilpakar, 2009)
	Leaves	treat wounds, loose bowels and dysenter	(Saklani and Chandra, 2012)
	Latex	used as anthelmintic as well as healing cuts, wounds and caries	
	Root-latex	treat mumps, cholera, loose bowels and vomiting	
Ficus benghalensis	Leaf bud, root	to manage loose bowels, vomiting, thirst, and fevers, as well as hemorrhages and bleeding piles	(Abbafati et al., 2020)
	Leaf bud	promoting conception, blood purifier in skin maladies, urinary and urinogenital disorders	(Murti et al., 2010)
	Fruits, airborne roots, bark, and leaves	to control diabetes, diarrhea, dysentery, menorrhagia, anxious, and tonic properties	(Verma et al., 2015)
	Leaves	treat influenza, diarrhea, fuel, decoction	(Zahoor et al., 2017)
	Airborne roots	headstrong spewing and leucorrhoea and ostyeomalacia of the limbs	(Murti et al., 2010)
	Bark	in burning sensation, haemoptysis, hemorrhages, diarrhea, dysentery, diabetes, enuresis, ulcers, skin maladies, gonorrhea, leucorrhoea, and hyperpiesia	
	Leaves	ulcers, leprosy, unfavorably susceptible conditions of skin, burning sensations and abscesses	
	Buds	diarrhea and dysenter	
	Fruits	vitiated condition of pitta	
	seeds	sores and ulcers, soles of the feet when broken or inflamed and in rheumatism	
	Latex	neuralgia, stiffness and lumbago bruises, nasitis, ulorrhagia, ulitis, odontopathy, hemorrhoids, gonorrhea, inflammations, splits of the sole and skin maladies	
Ficus benjamina	Latex and fruits	to treat skin disorders, inflammation, piles, vomiting, leprosy, malaria, nose-diseases and cancer	(Imran et al., 2014)
	Steam	stomach clutter	(Kala, 2005)
	Whole plant	blood purification	(Arshad et al., 2011)
Ficus carica	fruits, leaves, and branches	in constipation and piles	(Akhtar and Begum, 2009)
	Fruits pile	leprosy, nose dying, antipyretic, aphrodisiac, lithontriptic, hair-nutritive, emollient, demulcent, laxative and in treatment of different inflammations, paralysis, liver diseases, chest pain,	(Gilani et al., 2008)
	Roots	used as tonic, and treat leukoderma and ringworm infection	
	Latex	utilized as expectorant, diuretic, anthelmintic and iron deficiency	
	Leaves	utilized as antidiabetic, vermifuge	
Ficus deltoidea		can constrict the womb and vaginal muscle, improve blood circulation and to treat the menstrual cycle issue	(Mustapha and Harun, 2015).
	Leaves	used in diabetics	(Choo et al., 2012 Aug 1)
	Roots and leaves	utilized to treat wounds, stiffness, bruises	(Rosnah et al., 2015)
	Fruits	chewed to diminish toothache, cold and headache	
	Whole plant	a sexual enhancer tonic and as health tonic by ladies	
	Leaves	skin care as well as treatment of cancer	(Mustapha and Harun, 2015)
		watery lung, diabetes, kidney issue, high blood pressure and loose bowel	
Ficus exasperata	Leaves	used ulcer, lower blood pressure	(Oboh et al., 2014 Nov)
		the management, control or treatment of hypertension and other cardiovascular dysfunctions	(Odunbaku et al., 2008)
		treatment of cardiac arrhythmias. respiratory tract infections such as asthma, bronchitis, tuberculosis and emphysema	(Bafor and Igbinuwen, 2009)
		chest pain	(Bafor and Igbinuwen, 2009)
		Diarrhea	(Mouho et al., 2018)
		to treat furred tongue, tonsillar, throat inflammation,	(Chhabra et al., 1984)
	Plant tissue	orms, hemorrhoids, unusual extension of the spleen and to relieve hack	
	Rootbark	asthma	
	Viscid non-milky sap	treatment of eye troubles and stomach torment	(Bafor and Igbinuwen, 2009)
		to stop bleeding	
	Steam bark	treat wounds, boils and burns)	
Ficus microcarpa	dried leaves, airborne, roots, and bark	controlling sweat, easing fever, calming torment, treat flu, jungle fever, intense enteritis, tonsillitis, bronchitis, rheumatism and type-2 diabetes	(Chiang Chan et al., 2017)
	Leaves and fruits	allergic conditions, nausea and skin itching	(Wangpan et al., 2019)
	Leaves, ethereal roots, and bark	decreasing fever, soothing pain, and the treatment of liver maladies	(Rjeibi et al., 2017)
	Bark	used in ulcers, burning sensation, hemorrhages, leprosy, itching, toothache	(Gunasekaran and Balasubramanian, 2012)
		used to treat diabetes and liver malady	(Nair and Mahesh, 2016;5 (5):102.)
		to reduce fever and dysentery	(Padal et al., 2013)
Ficus racemosa	Bark, fruits, leaves, roots, latex and seeds	utilized in disorders like diabetes, liver disorders, loose bowels, inflammatory conditions, hemorrhoids, respiratory and urinary maladies	(Deep et al., 2013)
	Leaves	utilized to treat wounds, ulcer, dysentery, loose bowels, bilious infection	(Mandal et al., 2000)
	Bark	condition like threatened premature birth, urological disorders, diabetes, hiccough, leprosy, diarrhea, heaps and ulce	(Deep et al., 2013)
		wounds, and in treatment of asthma, heaps and menorrhagia	(Ferdous et al., 2008)
	Root	nflammatory glandular extensions, hydrophobia, mumps, loose bowels, pectoral complaints and diabetes	(Gunasekaran and Balasubramanian, 2012)
	Latex	hemorrhoids, the runs, diabetes, bubbles, traumatic swelling, toothache and vaginal maladies	(Deep et al., 2013)
	Bark and leaves	utilized in diarrhea, menorrhagia, compelling remedy in glandular swelling, boil, persistent wounds, cervical adenitis and hemoptysis	
Ficus religiosa	Whole plant	asthma, hack, gonorrhea, loose bowels, dysentery, vermicide, ulcers, leucorrhea, molar torment, cardiac issue, menorrhagia, vaginal and other urogenital disorders,	(Akhtar and Begum, 2009)
		hemorrhoids and a few central nervous systems (CNS) disorders, including epilepsy	(Singh et al., 2012)
	Root	sexual disorders, arthritis, elephantiasis, stomatitis, leprosy, malarial fever, respiratory maladies, chicken pox, epilepsy, burns and wounds.	(Khan et al., 2011)

(*continued on next page*)

Table 2 (*continued*)

Species	Plant part	Utilization	Reference
	Bark	utilized as astringent, love potion, antibacterial, anmd to treat gonorrhea, loose bowels, dysentery, hemorrhoids, gastrohelcosis, inflammation, burns, scabies, hiccup and heaving	(Makhija et al., 2010)
	Leaves	utilized in asthma, cough, sexual disorders, the runs, haematuria, toothache, migraine, eye troubles, gastric issues, scabies, tuberculosis, fever, loss of motion and hemorrhoids	
	Fruits	asthma, purgative, digestive, tuberculosis, fever, paralysis and hemorrhoid	
	Latex	used in neuralgia, inflammations and hemorrhages	
Ficus sycomorus		cough, loose bowels, skin infections, stomach disorders, liver malady, epilepsy, tuberculosis, lactation disorders, helminthiasis, barrenness, sterility and diabetes mellitus	(Dluya et al., 2015)
	Steam bark	treatment of sore throat, scrofula, respiratory and chest maladies,	(Maregesi et al., 2007)
		to treat sore, boils, peptic ulcers, jaundice, vaginal or butt-centric and fungal infections of gut	(Erhirhie et al., 2018)
		gastrointestinal tract issues, diabetic complications, infertility, low sperm count, human sterility, breast milk production, excessive menstrual and sometimes in treatment of cancer	(Dluya et al., 2015)
	Leaves	in jaundice and as an antidote for snakebite	(Maregesi et al., 2007)
	Fruits	used in stomach pain and tuberculosis	
	Whole plant	in respiratory disorders and certain skin diseases	(Erhirhie et al., 2018)

and stubborn spitting. The leaves are highly beneficial as a remedy for ulcers, leprosy, overly sensitive skin diseases, burning pains, and abscesses. The buds are useful in cases of dysentery and diarrhea, and in cases of vitiated pitta, the fruits are useful. In cases of neuralgia, lumbago, bruising, mastitis, menorrhagia, ulitis, odontopathy, hemorrhoids, gonorrhea, inflammations, splits of the sole, and skin ailments, latex might be beneficial. The milky juice and seeds can be used locally for wounds, ulcers, cracked or irritated foot soles, and rheumatism for relief (Murti et al., 2010).

F. benjamina has different medicinal potency, which is why native populations have long relied on it as a treatment for a variety of medical issues, including infections, pain, fever, hypotension, and dysentery. Native Americans also employ its latex and fruit extracts for a variety of medical purposes, including the treatment of skin conditions, inflammation, piles, vomiting, leprosy, malaria, nasal ailments, and cancer. It is also utilized as a general tonic (Imran et al., 2014). Additionally, its steam is utilized for stomach clutter (Kala, 2005), as well as, the entire plant is used for blood purification (Hussain et al., 2010; Arshad et al., 2011).

The extrication of *F. carica* has been utilized for numerous centuries for external and internal uses (Ahmad et al., 2013). It has numerous therapeutic employments and is traditionally employed for its therapeutic benefits as a metabolic, cardiovascular, respiratory, antispasmodic, and anti-inflammatory cure (Ahmad et al., 2013; Gilani et al., 2008). Its fruits; leaves, and branches are utilized for constipation and piles (Akhtar and Begum, 2009); Additionally, the traditional medical system makes use of its fruit, root, and leaves to treat a variety of illnesses. These include gastrointestinal issues like colic, indigestion, loss of appetite, diarrhea, and respiratory concerns like sore throats, coughs, and bronchial problems. A condition that causes inflammation and heart problems (Gilani et al., 2008). The fruits of the *F. carica* plant are used for a variety of medicinal purposes, including the treatment of leprosy, nose bleeding, fever, inflammation, paralysis, liver illness, chest discomfort, piles, and lithontriptic, emollient, demulcent, and laxative effects. Additionally, various components of the plant are used for various purposes, such as the roots for tonic, leukoderma, and ringworm infections; the latex for expectorant, diuretic, anthelmintic, and iron deficiency; the leaves for antidiabetic, vermifuge, contact dermatitis in humans, and phototoxicity in animals; and the seeds for edible oil and lubricant. The iron it contains makes it a perfect diet for people with anemia (Gilani et al., 2008).

F. deltoidea is a well-known conventional medication, which is popularly utilized within East Coast Malaysia for postpartum treatment as it is accepted can constrict the womb and vaginal muscle, improve blood circulation, and treat the menstrual cycle issue (Mustapha and Harun, 2015). Again, in Malaysia, its leaves are traditionally utilized by diabetics (Choo et al., 2012 Aug 1); similarly, the plant's powdered roots and leaves have been used for ages to cure a variety of ailments, including wounds, stiffness, bruises, and more (Rosnah et al., 2015). In Indonesia, its fruits are customarily chewed to diminish toothache, cold, and headache, as well as the whole tree, is utilized as a sexual enhancer tonic and as a health tonic by ladies (Rosnah et al., 2015). It is accepted that the leaves of the tree have an emulsifying impact and the herb has essential ingredient-rich terpenoids, so the leaves' decoction is utilized to decrease excessive cholesterol within the artery and toxin within the body, and the herbs utilized in skin care as well as treatment of cancer. It is additionally believed that *F. deltoidea* can anticipate and cure maladies like watery lungs, diabetes, kidney issues, high blood pressure, and loose bowels, and finally, it serves as a health tonic or taken as home-grown tea to restore and recapture the body strength (Mustapha and Harun, 2015).

As traditional pharmaceuticals, various parts of the *F. exasperata* plant have been utilized for several pathologies (Bafor and Igbinuwen, 2009). Its leaves are traditionally utilized to treat several issues; including inflammatory ones, different infections, haemostative ophthalmia, coughs, hemorrhoids, cardiovascular maladies, bleeding, and troublesome childbirth (Mouho et al., 2018; Oboh et al., 2014 Nov; Odunbaku et al., 2008). In Nigeria, the young leaf extract is utilized to treat ulcers and to lower blood pressure for treatment of problematic heart, especially where the hypertensive patient had taken the extract orally after decoction or maceration. Meanwhile, in Western Nigeria where, the people speaking Yoruba have long relied on the leaves as an ancient cure for high blood pressure as well as heart problems (Mouho et al., 2018; Oboh et al., 2014 Nov; Odunbaku et al., 2008). Tropical diseases like emphysema, tuberculosis, asthma, and bronchitis are treated with a mixture of leaves and lemon juice in the Ivory Coast, while cardiac arrhythmias are managed with a mixture of leaves and palm oil (Bafor and Igbinuwen, 2009). As folk medicine, Gambian people manage pain related to the chest by the stems of boiled water containing the leaves of the plant, which have been inhaled by the patient, while in Cameroon, the leaves are utilized for diarrhea (Mouho et al., 2018; Bafor and Igbinuwen, 2009 Jun 22). In addition, the leaf wrapped around a finger is rubbed on the affected part to treat furred tongue, tonsillar, and throat inflammation; essentially, in ophthalmic conditions, water and shaken leaves are taken; besides, it has been reported that the leaves have anthelmintic and hypoglycemic potential (Oboh et al., 2014 Nov; Chhabra et al., 1984). Furthermore, other parts of *F. exasperata* such as blossoms are utilized for ascaricide and sore throat; decoctions of plant tissue are used against worms, hemorrhoids, the unusual extension of the spleen and to relieve hack; decoction of rootbark drunk are utilized against asthma; in the Ivory Coast, a thick, non-milky sap is used to alleviate stomachaches and eye problems, while in Ghana, it is used to stop bleeding as well as a poultice of stem bark is utilized to treat wounds, boils and burns (Bafor and Igbinuwen, 2009 Jun 22; Chhabra et al., 1984). Once more, it has been reported that, traditionally *F. exasperata* are also used by birthing experts to speed up the process of giving birth and by cows to speed up the process of placenta extraction following calf delivery (Bafor and Igbinuwen, 2009

Jun 22).

The people of various nations utilize *F. microcarpa* as traditional medication (Rjeibi et al., 2017), in particular people of Okinawa, Japan utilize dried leaves, airborne, roots, and bark of the species as a folk medicine for controlling sweat, easing fever, and calming torment, moreover, the species is widely used as a shade tree in China and has traditional medicinal uses for a variety of illnesses, including a cold, jungle fever, severe enteritis, tonsillitis, bronchitis, and rheumatism, whereas, South Asian people utilized the species to treat type-2 diabetes (Chan et al., 2017). Furthermore, when in touch with the toxic plant components, the leaves and fruits alleviate allergic reactions, nausea, and skin itching (Wangpan et al., 2019). Furthermore, *F. microcarpa* dry leaves, ethereal roots, and bark were utilized in folk pharmaceuticals for decreasing fever, soothing pain, and the treatment of liver disorders (Rjeibi et al., 2017). Mainly, the bark is traditionally utilized in the treatment of diabetes, ulcers, burning sensation, hemorrhages, leprosy, itching, liver disorder, toothache fever, and dysentery (Padal et al., 2013; Nair and Mahesh, 2016;5(5):102.; Gunasekaran and Balasubramanian, 2012). Besides, it has been reported that the species has antipyretic, antioxidant, antibacterial, and pain-relieving properties (Rjeibi et al., 2017).

All ancient sacred writings of Ayurveda, Siddha, Unani, and Homeopathy specified *F. racemosa* as a traditional pharmaceutical for a wide range of afflictions. For instance, its bark, fruits, leaves, roots, latex, and seeds have been used therapeutically for many years, sometimes in conjunction with other spices, particularly to treat a variety of illnesses including diabetes, liver problems, loose bowels, inflammatory diseases, hemorrhoids, respiratory and urinary problems (Deep et al., 2013). Specially; leaves are utilized to treat wounds, ulcers, dysentery, loose bowels, and bilious infections as well as utilized as a mouthwash in spongy gum; bark is used in tricky conditions like threatened premature birth, urological disorders, diabetes, hiccoughs, leprosy, diarrhea, heaps and ulcer (Gunasekaran and Balasubramanian, 2012; Deep et al., 2013; Mandal et al., 2000). Similarly, the decoction of the bark of the species is utilized as a wash for wounds and in the treatment of asthma, heaps and menorrhagia, where the ethanolic extract of bark is used as hypoglycemic and antiprotozoal (Ferdous et al., 2008); roots of the species are, by and large, utilized in the treatment of inflammatory glandular extensions, hydrophobia, mumps, loose bowels, pectoral complaints and diabetes (Gunasekaran and Balasubramanian, 2012; Deep et al., 2013; Mandal et al., 2000); latex is aphrodisiac and used in treatment related to hemorrhoids, the runs, diabetes, bubbles, traumatic swelling, toothache and vaginal maladies (Deep et al., 2013); fruits or fruit extracts of the species are astringent, stomachic, refrigerant, stomachic, purgative, antiasthmatic, antioxidant, hepatoprotective, styptic, tonic and carminative, which traditional uses include treating dry coughing, voice problems, kidney and spleen diseases, leucorrhoea, blood disorder, burning sensation, exhaustion, urinary discharges, illness, intestinal worms, miscarriage, menstrual bleeding, spermatorrhoea, malignancy, scabies, hemorrhage visceral obstructions, diabetes, leucoderma, skin wound aggravation, lymphadenitis, sprains, and fibrositis. Moreover, fruit extract of the species has anti-filarial action against *Setaria cervi* (Rao et al., 2008; Gunasekaran and Balasubramanian, 2012; Deep et al., 2013; Mandal et al., 2000). In addition, the mixture of bark and leaves are used to treat diarrhea, menstrual bleeding, glandular swells, boils, recurrent infections, neck adenitis, and hemorrhaging (Deep et al., 2013).

F. religiosa has a place for Rasayana, which is a class of Ayurveda traditionally utilized as rejuvenators, antioxidants and push relievers (Makhija et al., 2010). It is traditionally utilized in the treatment of asthma, hack, gonorrhea, loose bowels, dysentery, vermicide, ulcers, leucorrhea, molar torment, cardiac issue, menorrhagia, vaginal and other urogenital disorders, hemorrhoids and a few central nervous systems (CNS) disorders, including epilepsy (Akhtar and Begum, 2009;

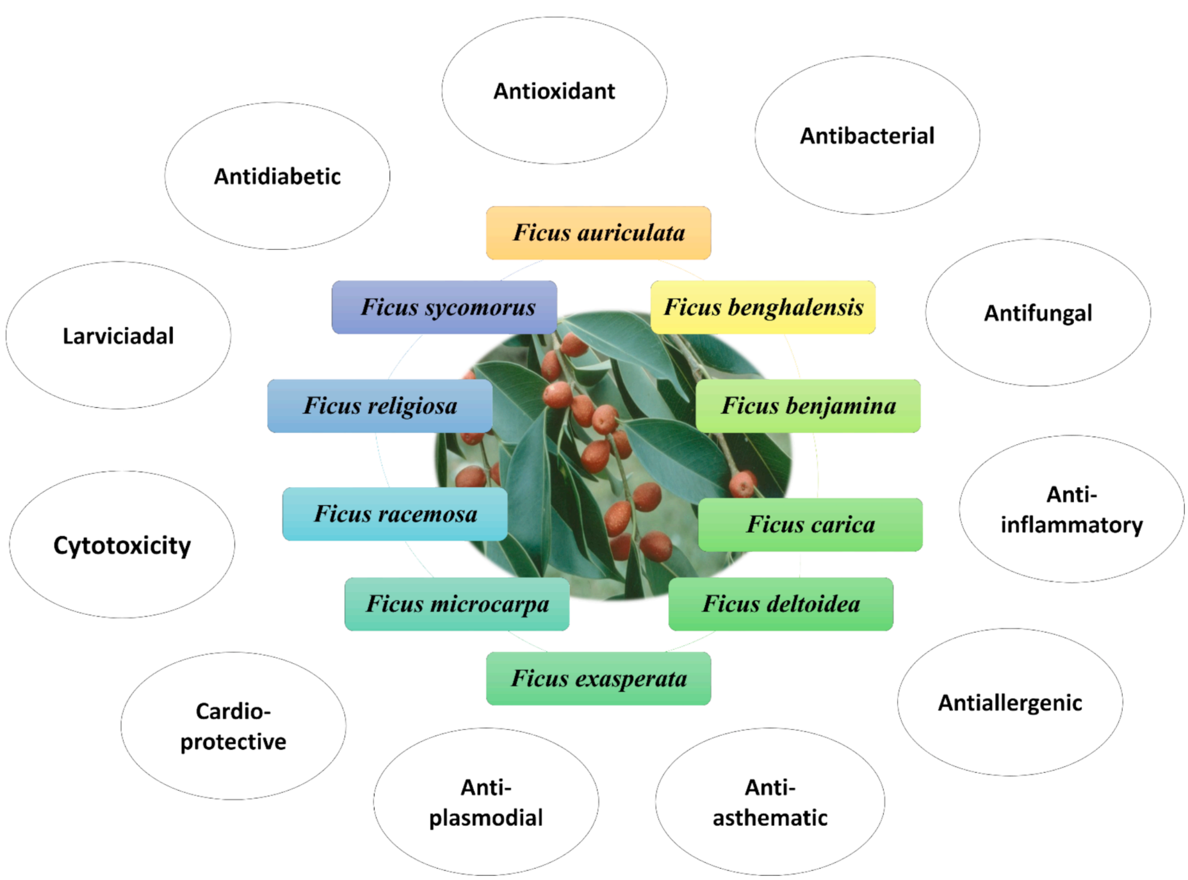

Fig. 3. Pharmaciological effects of common species of the genus *Ficus*.

Singh et al., 2012). In particular, the root of the species is utilized in the local community for the treatment of reproductive diseases, arthritic conditions, elephant fever, diarrhea, leprosy, malarial fever, respiratory diseases, chicken pox, epilepsy, burns, and infections (Singh et al., 2012; Khan et al., 2011). Moreover, the bark utilized as an astringent, love potion, antibacterial against *Staphylococcus aureus* and *Escherichia coli*, and to treat gonorrhea, loose bowels, dysentery, hemorrhoids, gastrohelcosis, inflammation, burns, scabies, hiccup and heaving; leaves utilized in asthma, cough, sexual disorders, the runs, haematuria, toothache, migraine, eye troubles, gastric issues, scabies, tuberculosis, fever, loss of motion and hemorrhoids; fruits utilized in problems related to asthma, purgative, digestive, tuberculosis, fever, paralysis and hemorrhoids; latex used in neuralgia, inflammations and hemorrhages (Makhija et al., 2010).

The people of African nations utilize extrication of distinctive plant parts of *F. sycomorus* in treatment related to cough, loose bowels, skin infections, stomach disorders, liver malady, epilepsy, tuberculosis, lactation disorders, helminthiasis, barrenness, sterility, and diabetes mellitus (Dluya et al., 2015). In folk medication, boiled steam bark of the plant is utilized in the treatment of sore throat, scrofula, respiratory and chest maladies, sore, boils, peptic ulcers, jaundice, vaginal or buttcentric infections as well as fungal infections of the gut (Erhirhie et al., 2018; Maregesi et al., 2007), whereas the decoction of stem bark used in gastrointestinal tract issues, diabetic complications, infertility, low sperm count, human sterility, breast milk production, excessive menstrual and sometimes in the treatment of cancer (Erhirhie et al., 2018; Dluya et al., 2015). Again, its leaves are used in jaundice and as an antidote for snakebite; fruits are used in stomach pain and tuberculosis, and finally the whole plant is used in respiratory issues and several skin problems (Erhirhie et al., 2018; Maregesi et al., 2007).

8. Biological activities

8.1. Plant extracts

8.1.1. Ficus auriculata

People have been using plants and their parts for medicinal purposes for a long time because of the bioactive substances they contain. Notable pharmacological effects have been associated with plants of the *Ficus* family (Fig. 3). *F. auriculata* methanolic extracts appeared to have antioxidant potential with IC_{50} value within the 40–60 μg/mL concentration range w/v (Kumari et al., 2018). While water and ethanolic extracts of *F. auriculata* leaves obtained by ultrasound appeared to have awesome antioxidant action with IC_{50} esteem of 182.87 ± 2.32a (for young leaves extracts) and 153.77 ± 1.48a (for mature leaves extracts) by free radical 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging test using gallic acid. In contrast, gallic acid IC_{50} esteem was 21.66 ± 0.19 (Bertoletti et al., 2018). In the interim, other extracts of young or mature leaves by using water and ethanol, water and ethanol with cellulase complex, water with cellulase complex, and only water too showed antioxidant activity. Still, in contrast, both leaves extracted by water with cellulase complex appeared to have the least antioxidant action (Bertoletti et al., 2018). Additionally, methanolic extracts of *F. auriculata* leaf showed antibacterial activity against *E. coli*, which causes diarrhea, abdominal torment, and fever, and *S. typhimurium*, which causes gastroenteritis with the zone of inhibition esteem of 18.33 ± 0.67 mm and 17.67 ± 0.33 mm at a concentration of 850 μg/mL w/v respectively (Kumari et al., 2018). Ethanolic fruit extracts of *Ficus auriculata* showed significant antimicrobial action against a few food-poisoning microbes, including *Shigella flexneri, E. coli,* and *Staphylococcus epidermidis*. In contrast, the zone of inhibition esteem was 14 ± 1 mm, 13 ± 1 mm, and 12 ± 1 mm, respectively (Saklani and Chandra, 2012). Other hands, water, and ethanolic leaves extract obtained by ultrasound showed antimicrobial action against both gram-positive (+) and negative (−) bacteria, *counting E. coli, Salmonella enteritidis, S. aureus,* and *Listeria monocytogenes* with minimum inhibitory concentration (MIC) of 21.60–90.32 $\mu g.ml^{-1}$, 21.60–188.85 $\mu g.ml^{-1}$, 4.22–188.85 $\mu g.ml^{-1}$ and 76.31–87.82 $\mu g.ml^{-1}$ respectively (Bertoletti et al., 2018). Another study observed that unrefined extracts of stem bark of *F. auriculata* showed significant alpha-amylase activity. Hence, the extracts can be effective in postprandial hyperglycemia and type-2 diabetes (Tiwari et al., 2017). Again, the leaves extract (500 mg/kg) of the species has been found to have noteworthy anti-inflammatory action on the carrageenin-induced rat hind paw oedema model (El-Fishawy et al., 2011).

8.1.2. Ficus benghalensis

A study proved that aqueous and ethanolic extracts of *F. benghalensis* roots showed antimicrobial activity against *S. aureus*, *E. coli*, and *Klebsiella pneumonia*, since 75 mg/ml of both extracts zone of inhibition was 14 mm, 12 mm, 14 mm, and 30 mm, 24 mm, 22 mm respectively, in comprise of 10 mcg/disc standard ampicillin, which zone of inhibition was 40 mm, 35 mm, 30 mm respectively (Murti and Kumar, 2011). Likewise, in another study, o.4 mg/well aqueous, methanol and chloroform extracts of the species root had antimicrobial potential against six bacteria strains including, *E. coli, E.coli mutants, S. aureus, Bacillus subtilis, K. pneumoniae* and *Pseudomonas aeruginosae* and one fungal strain including *Aspergillus niger* with the zone of inhibition range (in mm) for aqueous extracts 7.16 + 0.26, 7.27 + 0.01, 7.82 + 0.03, 7.62 + 0.01, 6.7 + 0.09, 6.65 + 0.05, 6.35 + 0.07; for methanol extracts 10.35 + 0.15, 11.38 + 0.13, 10.26 + 0.18, 9.43 + 0.11, 8.3 + 0.11, 11.7 + 0.13, 6.35 + 0.16; and chloroform extracts 9.68 + 0.10, 10.55 + 0.12, 10.19 + 0.11, 8.55 + 0.07, 9.91 + 0.13, 9.92 + 0.14, 8.61 + 0.09 respectively (Aswar et al., 2008). The ethanol and methanol extracts from *F. benghalensis* root showed antioxidant potential, demonstrated by their ability to donate electrons and hydrogen, as well as scavenge radicals. Methanol extract exhibited higher antioxidant activity compared to ethanol extract in both DPPH and FRAP assays. Ascorbic acid and gallic acid were used as reference standards for comparison. This study also reported that 97 % Chloroform and 3 % Methanol extracts of the species aerial root can increase hair growth and decrease hair loss (Verma et al., 2015). The methanol extracts of *F. benghalensis* leaves exhibited larvicidal activity against *Culex quinquefasciatus, Aedes aegypti,* and *Anopheles stephensi* mosquito larvae. The lethal concentration (LC50) values for the early second, third, and fourth larvae varied for each species, indicating effectiveness against different developmental stages of the mosquitoes. (Govindarajan and Angelina, 2010). Again, 100 μg/ml, 50 μg/ml, and 25 μg/ml ethanol extracts of *F. benghalensis* leaves have shown antiplasmodial activity against *Plasmodium falciparum* which causes malaria, however, the zone of inhibition value was 82, 39 and 25 %, where the IC_{50} value was 52 μg/ml (Simonsen et al., 2001). Besides, *F. benghalensis* fruit chloroform extracts have exhibited antitumor activity in the potato disc bioassay as the percentage inhibition of tumors was > 20 % (Mousa et al., 1994). Moreover, aqueous, ethyl acetate and ethanol extracts of *F. bengalensis* bark showed a significant reduction in leucocytes as well as eosinophil count of pretreated mice by milk in the order given, which means these extracts have antistress potential as well as antiallergic potential in asthmatic condition (Taur et al., 2007). Finally, aqueous extract of *F. bengalensis* bark has conveyed significant antidiabetic and ameliorative activity in diabetic rats, where 500 mg/kg body weight/day of extracts showed a reduction in glucose level at 5 h in streptozotocin-induced diabetic fasted, fed and glucose loaded rats, as well as hypoglycemic activity equivalent to tolbutamide (100 mg/kg body weight/day) (Gayathri and Kannabiran, 2008).

8.1.3. Ficus benjamina

Methanolic extract of *F. benjamina* stem, root, and leaves exhibited antioxidant potency with IC_{50} values of 50.1, 58.81, and 49.86 μg/ml, respectively (Imran et al., 2014). Additionally, chloroform extracts of *F. benjamina* fruits have manifested antimicrobial activity against some Gram-positive (+) bacteria including *B. cereus, B. megaterium, B.*

thuringiensis, Micrococcus luteus, S. aureus, Staph. epidermis, Streptococcus faecalis, Strep. faecium, and *Strep. lactis,* as well as, some Gram-negative (−) bacteria including *E. coli, K. pneumonia, Proteus vulgaris,* and *P. aeruginosa* (Mousa et al., 1994). However, n-butanol extracts of stems and leaves of *F. benjamina* have shown antimicrobial activity against two fungal strains include *Aspergillus niger* and *Candida albicans,* with zone of inhibition 21.13 ± 0.51 and 19.50 ± 0.29 mm, respectively for *A. niger* and 21.38 ± 0.36 and 19.75 ± 0.43 mm for *C. albicans* (El-Fishawy et al., 2011). Moreover, *Ficus benjamina* leaves crude ethanol extracts conveyed antiviral solid activity against Herpes Simplex Virus 1 (HSV-1), Herpes Simplex Virus 2 (HSV-2), and Varicella Zoster Virus (VZV) *in vitro* (Yarmolinsky et al., 2012). Again, the chloroform extracts of *F. benjamina* fruits have shown antitumor activity by inhibiting around 51 % of *A. tumefaciens* in the potato disc bioassay (Mousa et al., 1994). Besides, chloroform extraction of *F. benjamina* steam and leaves has manifested hemolytic activity with a percentage value of 3.36 and 3.29, respectively (Imran et al., 2014). Additionally, research showed that an ethanolic extract from dried *F. benjamina* leaves protected rat livers against carbon tetrachloride (CCl4)- induced damage. This was evidenced by a significant decrease in elevated levels of serum glutamic oxaloacetic transaminase, serum glutamic pyruvic transaminase, alkaline phosphatase, and total bilirubin, comparable to the effects of silymarin, a known hepatoprotective drug (Kanaujia et al., 2011).

8.1.4. Ficus carica

F. carica leaves extracted by 70 % methanol conveyed antioxidant activity in the DPPH assay compared to standard antioxidant Quercetin, where the extract RC50 value was 0.06666 mg/ml, and Quercetin RC_{50} value was 0.0039 mg/ml. Also, the extract has manifested a noteworthy reduction in myocardial infarction size with values of 12.5 ± 4.5, 12.6 ± 3.3 and 15.7 ± 3.1 %, respectively, for 0.04, 0.2, and 1 mg/ml extracts, meantime, the control group value was 56.6 ± 4.9 % (Allahyari et al., 2014). A study demonstrated that *F. carica* fruit extracts have exhibited strong inhibitory activity against both acetylcholinesterase and butyrylcholinesterase, which leads to protection from cardiovascular co-morbidities, such as obesity, hypertension, diabetes, and hypercholesterolemia, as well as, Alzheimer's disease, with IC_{50} values of 26.9 and 31.8μgmL − 1, respectively (Loizzo et al., 2014). Additionally, the study found that the extracts have a more significant antioxidant activity compared to vitamins C and E. Furthermore, the fruits of this plant and honey can prevent iron-mediated lipid peroxidation of low-density lipoprotein. Precisely, they form combinations with reduced metals and function as hydrogen donors (Loizzo et al., 2014). In another study, *Ficus carica* leaves extract has exhibited anti-inflammatory effects by locally inhibiting of tumor necrosis factor alpha (TNFα), prostaglandin E2 (PGE2), and vascular endothelial growth factor (VEGF) levels, while 5, 25, and 50 mg/pouch extracts respectively reduced 44.2 %, 46.9 %, and 57.8 %, TNFα concentrations; 50.6 %, 63.6 %, and 68 % PGE2 levels; 34.5 %, 35.2 %, and 56.0 % VEGF levels; as well as, 28.8 %, 25.0 %, and 46.2 % granulomatous tissue weight (Eteraf-Oskouei et al., 2015; 2015.). On the other hand, extracts from F. carica have demonstrated potent anti-angiogenic and anti-proliferative effects on human umbilical vein endothelial cells (HUVECs) in a dose-responsive way, with concentrations ranging from 100-400 μg/ml (Mostafaei et al., 2011). In addition, milky latex and fruits methanolic extracts of *F. carica* have deconstructed antimicrobial activity against *E. coli, P. aeruginosa, S. typhi, Trichophyton longifusus*, and *C. albicans* with antimicrobial assay value 0.74 ± 0.15, 0.67 ± 0.24, 0.12 ± 0.03, 1.17 ± 0.30 and 0.5 ± 0.2 μg/mL respectively, while, standard Cipro and Ampho.B zone of inhibition were 0.06, 1.5, 0.25, 0.1, 0.5 μg/mL respectively (Shad et al., 2014; 2014.). Besides, essential oils from fruit extract of *Ficus carica* have manifested antimicrobial activity against *B. subtilis* and *Ganoderma lucidum* with 14- and 10-mm zones of inhibition respectively (Hanif et al., 2010). Again, methanol extracts of the species leave have manifested antimicrobial activity against methicillin-resistant *S. aureus* (MRSA) isolated in the clinic, additionally, the extract conveyed a synergistic effect in combination with oxacillin or ampicillin against MRSA (Lee and Cha, 2010). Moreover, ethanol extract of *F. carica* has shown an antipyretic effect, where a dose of 100 mg/kg body weight of the extract conveyed a noteworthy reduction in yeast-provoked elevated body temperature of rats within four hours (Patil et al., 2010).

8.1.5. Ficus deltoidea

Methanolic leaf extracts of seven verities of *Ficus deltoidea* have shown significant antiglycation activity via inhibiting the synthesis of protein carbonyl by 1.36–1.76 percent, increasing the amounts of thiol groups by 64.3–53.7 percent, decreasing fructosamine by 47.0–86.5 %, and limiting the generation of fluorescent AGEs by 4.55–5.14 percent (Mohd Dom et al., 2020). Further, *F. deltoidea* leaves, stems and fruit extracts have shown moderate to weak antioxidant activity by drought stress, where the IC_{50} value of leaf extracts was 72.47 ± 0.050 μgmL^{-1}, stem extracts were 157.71 ± 0.036 μgmL^{-1} and fruit extracts was 401.20 ± 0.011 μgmL^{-1} under 40 % water field capacity (Kusuma et al., 2019). Furthermore, extracts from *F. deltoidea* leaves demonstrated promising protective effects against photo-aging in UVB-irradiated skin cells. They inhibited 21 % and 29 % of UVB-induced damage in dermal fibroblasts and HaCaT cells. Additionally, the extract exhibited anti-melanogenic effects in B16F1 melanoma cells, completely inhibiting melanin synthesis induced by α-MSH (Hasham et al., 2013). Chloroform extracts from two varieties of *F. deltoidea*, angustifolia and deltoidea, exhibited cytotoxic activity against LNCaP and PC3 cell lines of prostate cancer. The extracts demonstrated potency against both cell lines, with lower IC_{50} values indicating higher efficacy. (Hanafi et al., 2017). However, aqueous and ethanolic extracts from *F. deltoidea* leaves exhibited cytotoxic activity against a human ovarian carcinoma cell line (Akhir et al., 2011). Besides, the aqueous extract of *F. deltoidea* leaves anti-melanogenic activity by strong degradation of α-MSH activated tyrosinase in B16F1 melanoma (Oh et al., 2011). Furthermore, ethanol, methanol, and aqueous extracts of *Ficus deltoidea* leaves have shown antimicrobial activity against *B. subtilis* with a zone of inhibition value of 9, 10, and 8 mm respectively (Jamal et al., 2011). Additionally, aqueous and ethanolic extracts of *F. deltoidea* leaves have shown notable antithrombotic activity in rats, treated with alloxan monohydrate by significantly reducing the blood clotting rate, blood glucose levels and sperm abnormalities, also significantly improved the testosterone level, sperm count and motility, in specific, aqueous and ethanolic extract inhibited the clotting time 37.4 % and 47.7 % respectively, as well as increased testosterone level by 53.3 % and 32.4 % respectively (Nurdiana et al., 2012). Likewise, in another study, ethanolic extracts of the species have improved sperm quality by significantly increasing the activity of LDH-C4 isoenzyme activity by 36 % (Samsulrizal et al., 2011).

8.1.6. Ficus exasperata

Stem bark extracts of *F. exasperata* have shown antimicrobial effects against P. aeruginosa, S. typhi, K. pneumoniae, and *S. aureus* demonstrating respective inhibition zones of14.33 ± 0.33, 12.33 ± 0.33, 17.33 ± 0.67 and 15.0 ± 0.58 mm (Kingsley, 2013). However, *Ficus exasperata* leaf aqueous extract has conveyed hypoglycemic potential by significantly reducing the blood glucose concentrations from 22.6 ± 0.1 mmol/L to 10.2 ± 0.4, 8.4 ± 0.3 and 6.8 ± 0.1 mmol/L respectively after 10, 20 and 30 days of treatment on type-1 and from 18.9 ± 0.4 mmol/L to 8.2 ± 0.2, 7.6 ± 0.3 and 5.9 ± 0.4 mmol/L respectively after 10, 20 and 30 days treatment on type-2 diabetic induced rats group as well as, significantly increasing serum insulin level from 5.7 ± 2.3 μU ml^{-1} to 8.3 ± 1.4, 10.9 ± 1.3, 10.7 ± 2.3 μU ml^{-1} respectively after 10, 20 and 30 days treatment on type-1 diabetic induced rats group (Adewole et al., 2011). Also, the extracts has manifested hypolipidemic activity by altering high-density lipoprotein, low-density lipoprotein, total cholesterol and triglyceride level from 0.52 ± 0.3, 2.64 ± 0.4, 2.82 ± 0.6 and 2.52 ± 0.7 to 0.76 ± 0.2, 0.98 ± 0.4, 1.02 ± 0.6 and 1.05 ± 0.7 mmol/L on Type-1 diabetic induced rats group, and 0.48 ± 0.5, 3.27 ± 0.9, 4.25 ± 0.8 and 2.78 ± 0.3 to 0.69 ± 0.6, 1.20 ± 0.9, 1.35 ± 0.8

and 1.27 ± 0.3 mmol/L respectively on Type-2 diabetic induced rats group (Adewole et al., 2011). Again, hydro-alcoholic stem bark extract of *F. exasperata* has effectively reduced carrageenan-induced paw edema, with a maximal inhibitory rate of 68.57 ± 3.342 %. (Kingsley, 2013). In addition, *F. exasperata* aqueous stem bark extracts have possessed hepatoprotective potency by altering AST, ALT, ALP and Total Protein (TP) levels in paracetamol-induced hepatotoxic rats with value of 30.00 + 10.98 IU/L, 32.50 + 8.54 IU/L, 37.00 + 9.48 IU/L and 5.83 + 0.28 Mg/dl respectively for 200 mg/kg extracts (Enogieru et al., 2015). Moreover, *F. exasperata* leaf aqueous extract has exhibited renoprotective potency in diabetes mellitus induced Forty Wistar rats group by streptozotocin, by decreasing nitrite levels in urine, serum and tissues where serum creatinine, urine creatinine, serum urea, urine urea, urine albumin and serum albumin values were 0.85 ± 1.2, 65.3 ± 1.1, 26.1 ± 1.7, 95.2 ± 5.0, 16.4 ± 1.2 and 26.9 ± 1.2 mg/dL respectively, creatinine clearance and urea clearance were 1.09 ± 0.3 and 1.31 ± 0.1 mL/min (Adewole et al., 2012).

8.1.7. *Ficus microcarpa*

Ethyl acetate fraction of bark extract of *F. microcarpa* has manifested strong antioxidant activity with EC_{50} values of 4.83, 1.62, and 63.21 μg/ml in DPPH, ABTS +, and superoxide radicals scavenging methods, respectively. Likewise, various part of the species like bark, fruits, leaves, hexane, and aqueous fractions of bark extract also have manifested antioxidant activity, where EC_{50} for DPPH assay, ABTS + assay and PMS–NADH assay were respectively, 7.9 ± 0.1, 4.0 ± 0.0 and 97.5 ± 2.8 μg/ml for bark; 7.3 ± 0.0, 9.2 ± 0.1 and 179 ± 2.8 μg/ml for fruits; 21.4 ± 0.1, 10.2 ± 0.0 and 223 ± 2.2 μg/ml for leaves; 379 ± 13.0, 265 ± 10.1 and more than 1000 μg/ml for hexane fraction of bark extract; finally, 11.6 ± 0.1, 4.0 ± 0.0 and 83.9 ± 2.8 μg/ml for aqueous fractions of bark extract (Ao et al., 2008). Consequently, leaf, stem, root as well as whole extract of *F. microcarpa* have conveyed antimicrobial potency against *S. aureus*, *E. coli,* and *P. aeruginosa* with MIC values of 0.37, 9.37, and 37.5 mg/ml, respectively for stem extract, 37.5, 9.37 and 9.37 mg/ml for root extract, 9.37, 9.37 and 4.68 mg/ml respectively for whole plant extract, and 9.37 mg/ml for leaf extract against all microorganisms (Nair and Mahesh, 2016;5(5):102.). In another study, various extracts of *F. microcarpa* also showed antimicrobial activity against *E. coli, S. aureus,* and *C. albicans*, in which the zone of inhibition against these microorganisms for methanol extracts were 12, 17, and 12 mm, respectively; for ethyl acetate extracts were 10, 13, 11 mm respectively; and for n-butanol extracts were 14,15 and 12 mm respectively; but, methyl chloride extracts were active only against *E. coli* and *C. albicans* with 9 and 11 mm zone of inhibition (Ghareeb et al., 2015). Again, methanol extract of *F. microcarpa* root and leaf also exhibited antimicrobial activity with the zone of inhibition value 14.51 ± 0.3 and 10.33 ± 0.1 mm against *S. aureus* and 17.66 ± 0.2 and 11.32 ± 0.3 mm against *Micrococcus luteus* (Rjeibi et al., 2017). However, the ethyl acetate extract of bark of *F. microcarpa* has shown noteworthy hepatoprotective activity by stabilizing the biochemical parameters like Serum Glutamic Oxaloacetic Transaminase (SGOT), Serum Glutamic Pyruvic Transaminase (SGPT), ALP, Total Bilirubin (TB), Direct Bilirubin (DB) and TP level in a dose-dependent manner, where, 200 mg extract showed SGOT, SGPT, ALP, TB, DB and TP values equal to 85.25 ± 2.81 IU/l, 59.07 ± 3.53 IU/l, 108.70 ± 8.35 IU/l, 0.46 ± 0.06 mg/dl, 0.27 ± 0.04 mg/dl and 5.16 ± 0.28 gm% respectively (Surana et al., 2017). Besides, methanolic extract of *Ficus microcarpa* leaves possessed strong antidiarrheal activity on castor oil-induced diarrheal Albino rats, where the percentage of inhibition of diarrhea were 79.25 and 65.55 %, respectively for 300 and 600 mg/kg extracts, as well as, the small intestinal motility of the charcoal marker was inhibited by 23.92–31.12 % by the extract (Bairagi et al., 2014). Furthermore, water, N-butanol, ethyl acetate, methanol and membrane fraction of *F. microcarpa* leaves have exhibited noteworthy antitussive, expectorant, and antiasthmatic activities. In contrast, 200 mg/kg methanol fraction exhibited the most muscular antitussive and antiasthmatic activity in the mice group with 29.30 ± 5.17 s latency of coughing, 33.7 ± 3.8 coughs per hour frequency of coughing and 172.30 ± 116.99 s latency period of cavy; however, 200 mg/kg membrane fraction exhibited most robust expectorant activity on mice groups with 0.06 ± 0.02 Au OD and 1.01 ± 0.39 mg/l excretion values (Liu et al., 2009). Additionally, hexane extract of *F. microcarpa* leaves has manifested good hypolipidemic activity in hypercholesterolemic rats through counteracting LDL oxidation, enhancement of HDL synthesis, and inhibition of lipid peroxidation. As a result, the extract reduced total cholesterol, triglyceride, and LDL levels from 66.84 %, 66.86 %, and 77.70 % to 51.93 %, 30.76 %, and 70.76 %, respectively, and also increased HDL levels from 32.04 % to 63.29 % (Awad et al., 2011).

8.1.8. *Ficus racemosa*

The ethanolic extract of *F. racemosa* leaves has manifested noteworthy antioxidant activity by FRAP (Ferric Reducing Antioxidant Power) assay, scavenging activity against H_2O_2 and TBARS (Thiobarbituric Acid Reactive Species) assay with values equal to 0.739 mmol Fe II/g, 51.28 ± 0.91 and 61.46 ± 0.92 % inhibition rate respectively (Yadav et al., 2019). Similarly, root bark and heartwood extracts of *F. racemosa* have exhibited remarkable antioxidant activity by free radical scavenging activity using DPPH, where the IC_{50} value of the root bark was 5.80 μg/ml and heartwood was 4.49 μg/ml (Jain et al., 2013). A different study showed that ethanolic leaf extract of *F. racemosa* has possessed cytotoxic activity against Dalton Lymphoma Ascites (DLA) cell line by MTT assay where 200 μg/ml extracts inhibited 57.37 % of cells and showed an IC_{50} value of 175 μg/ml (Khan et al., 2017). In addition, the hydroalcoholic extract of *Ficus racemosa* has conveyed antibacterial activity against *Actinomyces viscosus* with a MIC concentration of 0.08 mg/ml (Shaikh et al., 2010). Again, aqueous and ethanolic extracts of roots of *Ficus racemosa* have shown antimicrobial activity against *S. aureus*, *E. coli,* and *K. pneumonia* in a dose-dependent manner, where the noteworthy result was found from 75 mg/ml ethanolic extract with 35-, 30- and 25-mm zone of inhibition respectively, while zone of inhibition of 75 mg/ml aqueous extract was 35-, 25- and 10-mm, respectively (Velayutham et al., 2013). However, ethanolic extract of *F. racemosa* bark and fruit has evinced vigorous antinociceptive activity on acetic acid-induced writhing in mice, where 500 mg/kg of fruit extract inhibited 61.38 % Writhing and 500 mg/kg bark extract inhibited 42.76 % Writhing (Ferdous et al., 2008). In studies, it was found that the aqueous bark extract of *F. racemosa* showed larvicidal activity against fourth instar larvae of filariasis vector, *Culex quinquefasciatus*, and Japanese encephalitis vectors, *Culex gelidus*. The crude aqueous extract of *F. racemosa* demonstrated the highest efficacy against the larvae of *C. quinquefasciatus* and *C. gelidus*, with LC50 values of 67.72 and 63.70 mg/L, respectively (Velayutham et al., 2013). Besides, ethanolic extracts of *F. glomerata* plant have displayed hypoglycemic activity on alloxan diabetic albino rats where initial + 3 to + 4 mg/dl urine sugar level decreased to nil within 1 week with a double dose of 250 mg/kg in a day (Kar et al., 2003). In addition, the extract from the leaves of *F. racemosa* has demonstrated its ability to shield the liver in rats that have been subjected to long-term damage caused by carbon tetrachloride, while, SGOT, SGPT, Alkaline phosphatase, and Bilirubin levels were 58.4 ± 1.1 IU/L, 41.2 ± 1.1 IU/L, 65.7 ± 1.2 U/L and 2.5 ± 0.03 g/L respectively (Mandal et al., 1999). Likewise, aqueous and ethanolic extract of roots of *F. racemosa* has conveyed healing properties, where topical use of aqueous and ethanolic extract reduced around 100 and 98.33 ± 1.32 % wound concentration, respectively within 16 days of treatment (Murti and Kumar, 2012). Additionally, the methanol extract of *F. racemosa* stem bark has demonstrated significant antitussive activity with a maximum inhibition of 56.9 % at a dose of 200 mg/kg (Bhaskara Rao et al., 2003).

8.1.9. *Ficus religiosa*

The ethanolic extract of *Ficus religiosa* leaves has manifested potential antioxidant activity by the DPPH radical scavenging method, where

200 μg/ml to 1000 μg/ml extracts showed dose-dependent peroxide values with a range of 6.34 % to 13.35 % (Charde et al., 2010). However, aqueous, methanol, and chloroform extracts of F. religiosa have conveyed potential antibacterial activity against Enterotoxigenic E. coli, which were isolated from diarrheal patients with a zone of inhibition value equal to 10, 14, and 12 mm for 4 mg/ml aqueous, methanol and chloroform extracts, respectively (Uma et al., 2009). Likewise, methanol and diethyl ether extractions of leaves and bark of *F. religiosa* have possessed antimicrobial activity against three bacteria, namely, *E.coli*, *S. aureus* and *P. aurignosa*, and one fungus namely, *A. niger*, where zone of inhibition of 40 mg/ml methanol leaves extract against those microbes were 2.4, 2.2, 2.8 and 1.6 mm respectively, and methanol bark extract were 1.8, 1.1, 2.2 and 1.2 mm respectively, in contrast, diethyl ether leave extract inhibited *E.coli*, *P. aurignosa* and *B. subtilis* with 1.0, 0.9 and 1.4 zone of imbibition, meanwhile, diethyl ether bark extract inhibited *E.coli* and *B. subtilis* with 0.9 and 1.2 mm zone of imbibition, respectively (Ramakrishnaiah and Hariprasad, 2013). Also, methanol extract of the dried fruits of *F. religiosa* has demonstrated anti-inflammatory activity by significant inhibition of carrageenan-induced rat paw edema, where 200 and 400 mg extract inhibited 29.25 and 49.64 % edema, respectively. On the other hand, the extracts also possessed analgesic activity by significant inhibition of acetic acid-induced writhing in mice, where, 200 and 400 mg/kg extract inhibited 42.23 and 57.76 % writhing, respectively (Mamidisetti et al., 2018). Additionally, ethanolic extract of *Ficus religiosa* has manifested strong anti-ulcer activity on stress-induced ulcer animal models, in which 250 and 500 mg extract showed ulcer index values equal to 2.30 ± 0.16 and 1.62 ± 0.11 mm^2/rat with 45.23 and 61.42 % protection respectively (Gregory et al., 2013). In a study, benzene and alcoholic extract of *Ficus religiosa* have shown anticancer activity on in-vitro human MCF 7 cell lines with IC_{50} values of 160.3 μM and 222.7 μM, respectively (Gulecha and Sivakuma, 2011). In another study, *F. religiosa* leaf extract-mediated copper oxide nanoparticles possessed cytotoxic activity against human lung cancer A549 cells by dimethyl thiazolyl tetrazolium bromide (MTT) assay, where at a lower concentration than 50 μg/ml showed 70 % viability. However, the cell viability was decreased by up to 6 % at a higher concentration of 500 μg/ml. Meanwhile, the IC_{50} value was 200 μg/ml (Sankar et al., 2014). Similarly, *Ficus religiosa* leaf extract and the extract-mediated liver fabricate silver nanoparticles (AgNPs) have shown anticancer activity against Dalton's Ascites Lymphoma (DAL) cells, which intraperitoneally incubated on Swiss Albino mice, where extract showed 3.7 ± 0.4 ml tumor concentration and only AgNPs showed 4.1 ± 0.5 ml tumor concentration, meantime IC_{50} value was approximately 50 g/ml (Sandabe et al., 2003). Moreover, aqueous extract of *Ficus religiosa* has possessed an anti-diabetic effect against type 2 diabetic rats induced by streptozotocin, where fasting glucose levels for 100 and 200 mg extract were 124.7 ± 3.6 and 110.4 ± 3.2 mg/dl respectively, following that, postprandial blood glucose level was found to be 155.2 ± 4.1 and 137.0 ± 3.5 mg/dl respectively (Kirana et al., 2011). Furthermore, methanol extract of figs of *Ficus religiosa* has manifested anti-amnesic potency with a noteworthy memory improvement in scopolamine-induced anterograde and retrograde amnesia mice. Meanwhile, the lowest transfer latency before learning was around 20 s, found from the second-day treatment of 100 mg extract. However, the latency decreased by around 50 % before retrieval, again, the lowest number of trials and mistakes before learning was around 3, found from the second-day treatment of 100 mg extract, which decreased before retrieval by around 20 % (Kaur et al., 2010). Finally, the aqueous leaf extract of *F. religiosa* has exhibited anti-asthmatic activity on histamine and acetylcholine-induced bronchospasm in an animal model of guinea pig, where 300 mg extract increased latency of pre-convulsion time of histamine and acetylcholine by 167.0 ± 5.7 and 273.0 ± 5.7 s respectively (Kapoor et al., 2011).

8.1.10. *Ficus sycomorus*

Two different extracts of fruits and leaves of *F. sycomorus* have exhibited antioxidant activity by DPPH radical scavenging assay, where IC_{50} values of ethanol and ethyl acetate extract of leaves were 18.443 and 33.348 μg/ml, respectively. Also, the ethanol and ethyl acetate extract of fruits were 20.312 and 37.652 μg/ml, respectively (El-Beltagi et al., 2019). Moreover, various crude extracts of *F. sycomorus* fruits have shown antimicrobial activity against four Gram-positive and Gram-negative bacterial strains, namely *E.coli*, *Proteus spp*, *S. aureus,* and *Haemophilus influenza*, in which 2 μg/ml butanol extract showed 8 ± 0.355, 12 ± 0.15, 10 ± 0.55 and 15 ± 0.14 nm zone of inhibition against those statins. However, 2 μg/ml of chloroform, ethyl acetate, methanol, and aqueous extracts showed zone of inhibition against *S. aureus, E. coli* and *Haemophilus influenza* with values equal to 8 ± 0.21, 9 ± 0.23 and 7 ± 0.51 nm; 7 ± 0.14, 11 ± 0.19 and 10 ± 0.23 nm; 9 ± 0.1, 10 ± 0.24 and 6 ± 0.12 nm; 11 ± 0.13, 14 ± 0.17 and 11 ± 0.10 nm, respectively, in contrast, 2 μg/ml of hexane showed activity only against *E. coli* and *S. aureus* with 7 ± 0.18 and 7 ± 0.13 nm zone of inhibition, respectively (Al-matani et al., 2015). Besides, methanol and acetone extract of *F. sycomorus* leaf and stem-bark have possessed antimicrobial activity against sensitive and resistant species of *S. aureus* and *Acinetobacter baumannii* pathogens, where methanol leaf extract showed zone of inhibition values equal to 16.5 ± 0.4, 15.0 ± 0.2, 23.0 ± 0.7 and 18.5 ± 0.5 mm, respectively, similarly, methanol stem-bark extract showed 18.0 ± 0.3, 16.0 ± 0.0, 23.5 ± 0.4 and 20.0 ± 0.5 mm, respectively; acetone leaf extract showed 18.0 ± 0.5, 16.0 ± 0.0, 26.0 ± 0.4 and 22.0 ± 0.2 mm respectively; finally, acetone stem-bark extract showed 19.5 ± 0.6, 18.0 ± 0.3, 27.0 ± 0.0 and 23.5 ± 0.7 mm, respectively (Saleh et al., 2015). In addition, *F. sycomorus* stem bark aqueous extract has exhibited antidiabetic activity by lowering blood glucose levels in alloxan-induced diabetic mice. While 150 mg/kgbw extract significantly lowered blood glucose level from an initial 166.8 ± 13.5 mg/dl to 36.4 ± 1.6 mg/dl within 4 h (Njagi et al., 2012). However, ethanol extracts of fruits and leaves of *F. sycomorus* have evinced anticancer activities by the reduction in the viability of liver cell line (HepG2), colorectal adenocarcinoma (Caco-2), and breast cell line (MCF-7) by a dose-dependent manner, where fruits extract showed IC_{50} values equal to 410, 416 and 290 μg/ml respectively against HepG2, Caco-2 and MCF-7 cell lines, and the leaves extract showed IC_{50} values equal to 750, 860 and 219 μg/ml respectively against HepG2, Caco-2, and MCF-7 cell lines, besides, a most significant result found from 3000 μg/ml fruits extract with variability values against those cell lines equal to 74 62 and 76 % respectively. Meanwhile leaf extracts viability values equal to 78, 81 and 71 % respectively (El-Beltagi et al., 2019). Also, *F. sycomorus* methanol stem-bark extract has conveyed hypoglycemic potential by lowering glucose levels in alloxan-induced type-2 diabetic albino Wistar rats, in which, 250 mg/kg extract decreased blood glucose level from 166.87 ± 24.87 mg/dl to 76.02 ± 11.32 mg/dl within 24 h (Adoum et al., 2012). Additionally, aqueous extract of the stem bark of *Ficus sycomorus* has manifested sedative activity by increasing amylobarbitone induced pattern of sleep-in rats as well as ketamine hydrochloride-induced anesthesia, where the 200 mg/kg extract with amylobarbitone sodium demonstrated a duration of sleep of 93.00 ± 3.16 min, and 300 mg/kg extract with ketamine demonstrated a duration of sleep of 17.25 ± 0.95 min (Sandabe et al., 2003). Again, the same study reported that aqueous extract of the stem bark of *F. sycomorus* conveyed anticonvulsive potency by decreasing pentylenetetrazole and strychnine-induced convulsions in rats, where, 600 mg/kg extract with pentylenetetrazole showed a mean number of convulsions/min equal to 49.0 ± 1.83, meantime, 600 mg/kg extract with strychnine showed 13.2 ± 0.96 convulsions/min (Sandabe et al., 2003). Furthermore, aqueous stem-bark extract of *F. sycomorus* has displayed testicle enlargement potential, where 600 mg/kg extract increased the scrotal diameter by 0.47 cm, and with a 30 days treatment showed an increased 12.4 ± 1.3 mg/g size index of the testis, also, showed enlarge length and mid-circumference of right and left testicular 2.4 ± 0.6, 2.4 ± 0.5, 3.4 ± 0.1 and 3.5 ± 0.3 cm, respectively after 30 days treatment (Igbokwe et al., 2010). The extract derived from the stem bark of *Ficus* sycomorus showed significant effects on depression,

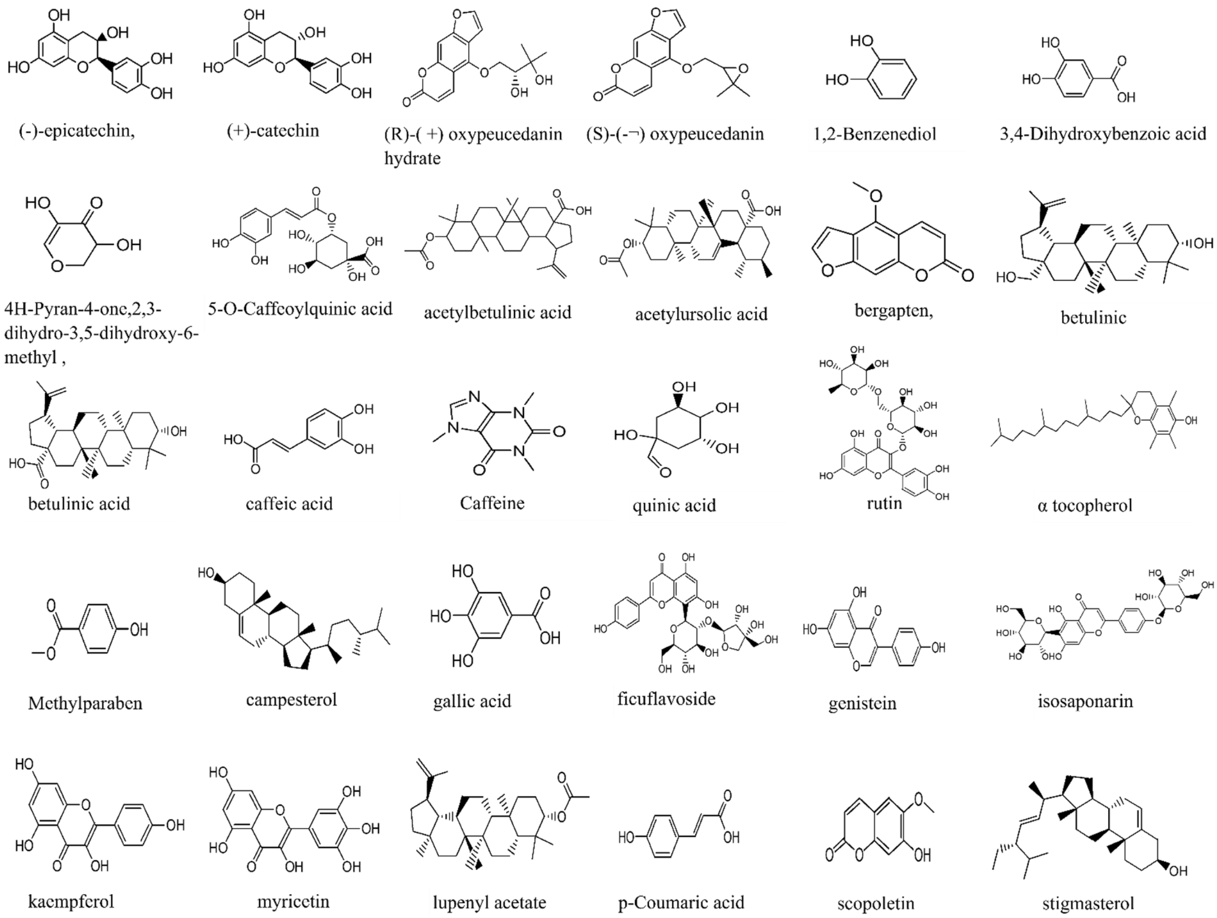

Fig. 4. Structures of some important identified phytochemicals from different species of "*Ficus*".

anxiety, and memory impairment caused by unpredictable chronic mild stress in anhedonic rats. When administered at a dosage of 100 mg/kg, it had a notable impact on the intake of sucrose and swimming time, as well as improving alternation in the Y-maze and increasing total glutathione content in the rat temporal lobe. It significantly decreased latency time in the novelty-suppressed feeding test, the duration and frequency of entries into closed arms, and decreased malondialdehyde (MDA) levels in the rat temporal lobe. Specifically, a 30 days treatment of 100 mg extract with UCMS showed sucrose consumption of around 200 g, as well as, a sucrose preference of around 100 %. Also, 100 mg extract with UCMS showed a swimming time of around 130 s, immobility time around 180 s, latency in the novelty-suppressed feeding test near 130 s and spontaneous alternation around 85 % with a quantity of 6 line crossing in the Y-maze, MDA value near 3e-005 mM/mg of proteins and GSH value between 2e and 006 and 3e-006 mM/mg of proteins, finally, 100 mg showed a time spending value of anhedonic rats around 230 s in open and closed arms with 3 entries in open and closed arms (Foyet et al., 2017).

8.2. *Specific phytochemicals*

8.2.1. *Ficus auriculata*

Ficus serves as a reservoir for numerous phytochemicals, showcasing a rich diversity of bioactive compounds within its structure (Figs. 4 & 5). The ether, chloroform and ethyl acetate fractions of alcoholic extracts of *F. auriculata* fruits and leaves contain betulinic acid, lupeol, stigmasterol, bergapten, scopoletin, β-sitosterol-3-O-β-D-glucopyranoside, myricetin, and quercetin-3-O-β-D-glucopyranoside which has shown antimicrobial potential against both gram-positive (+) bacteria include *S. aureus, B. aureus* and *B. subtilis*, and, gram-negative (−) bacteria include *E. coli* and *P. aeruginosa* by agar well diffusion method. Again, the presence of sterols and triterpenoids including betulinic acid, lupeol, stigmasterol and β-sitosterol-3-O-β-D-glucoside in fruit extract has shown significant anti-inflammatory activity (El-Fishawy et al., 2011). In addition, the leaves of the species possess strong antioxidant potential due to presence of phenolic compounds such as kaempferol, quercetin, myricetin, betulinic acid, lupeol, stigmasterol, bergapten, scopoletin, ß-sitosterol-3-O-ß-D-glucopyranoside, myricetin and quercetin-3-O-ß-D-glucopyranoside (Bertoletti et al., 2018).

8.2.2. *Ficus benghalensis*

Leaves of *F. bengalensis* contain catechin and genistein, thus they possess antibacterial efficiency against both Gram-positive (+) namely, *B. cereus,* and Gram-negative (−) namely, *P. aeruginosa* bacteria, where the catechin zone of inhibition, was 18.8 and 19 mm, and genistein zone of inhibition was 19 and 18.5 mm respectively (Almahy and Alhassan, 2011). Besides*, F. benghalensis* methanol extracts by GC–MS analysis demonstrated an abundance of several crucial phytochemicals, in particular quinic acid, palmitic acid, methyl ester, ergosterol acetate, and α-prenyl acetate, which showed antioxidant activity. As before, most of these compounds also manifested anti-inflammatory and anti-cancer activity. Specially lupenyl acetate and α-amyrenyl acetate hold anti-malarial, anti-bacterial, anti-fungal, anti-oxidant, anti-ulcer, anti-hyperglycemic and anti-cancer activity. Again, GS-MS analysis of *F. benghalensis* aerial roots exhibited lupenyl acetate, α-amyrenyl acetate, γ-sitosterol, palmitic acid, and lupeol, which have antibacterial, antioxidant, anti-inflammatory, anti-diabetic, and anti-cancerous potential (Verma et al., 2015).

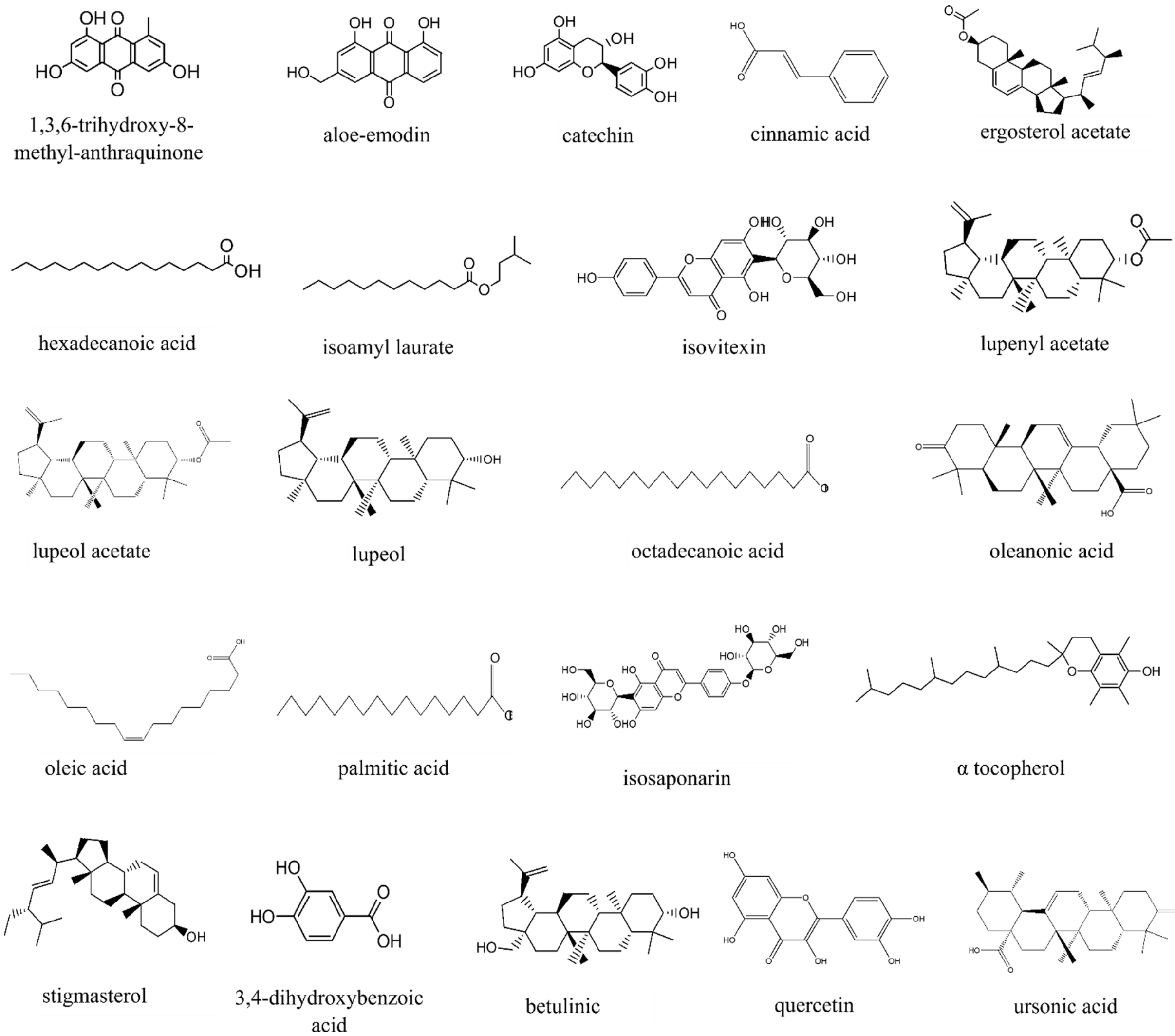

Fig. 5. Continuation of Fig. 4.

8.2.3. *Ficus benjamina*

In a study, six phytochemicals including cinnamic acid, lactose, quercetin, caffeic acid and stigmasterol obtained from *F. benjamina* leaves, barks, and fruits were screened for antimicrobial activity against *B. cereus* and *P. aeruginosa*, and cytotoxic activity against T-lymphoblastic leukemia (CEM-SS) cell line. Hence, it was reported that quercetin and naringenin exhibited stronger antibacterial activity against both bacteria, where cinnamic acid and lactose showed potent activity against the *P. aeruginosa* and moderate activity against the *B. cereus*, however caffeic acid and stigmasterol yield weak activity against the two species of those bacteria, in addition, only caffeic acid manifested powerful cytotoxic potency with IC_{50} value of 25 mg/mL (Almahy et al., 2003). Again, three flavone glycosides, quercetin 3-Orutinoside, kaempferol 3-O-rutinoside and kaempferol 3-O-robinobioside obtained from *F. benjamina* showed antivirus activity against Herpes Simplex Virus 1 (HSV-1) and Herpes Simplex Virus 2 (HSV-2) with selectivity index (SI) of 266, 100 and 666 respectively for HSV-1 virus (Yarmolinsky et al., 2012).

8.2.4. *Ficus carica*

Strong cytotoxic activity has been found in 6-O-acyl-β-D-glucosyl-β-sitosterols in conjunction with its palmitoyl, linoleyl, stearyl, and oleyl derivatives isolated from the fruit of *F. carica* (Lee and Cha, 2010). Some phytochemicals such as β amyrins, stigmasterol, campesterol, ϒ sitosterol, oleic acid, isoamyl laurate, α and ϒ tocopherols in dried fruits of *F. carica*, however various studies have been reported that these phytochemicals have various biological potency, for example, β amyrins has very significant glycyrrhizin potency; stigmasterol has the potency to manufacture semi-synthetic progesterone hormone, as well as, potency to prevent certain kind of cancers, including ovarian, prostate, breast and colon cancers, it also act as an antioxidant, hypoglycemic and thyroid inhibitor; campesterol convey anti-inflammatory activity; ϒ sitosterol has antimicrobial and antioxidant activities, as well as, potency to reduce saturated fat and cholesterol, thus, may reduce the risk of heart diseases; oleic acid act as emollient; isoamyl laurate has the potency to conditioning hair; α tocopherols has antioxidant potency, which leads to slowing aging; ϒ tocopherols has inflammation and anticancer potency (Soni et al., 2014).

8.2.5. *Ficus deltoidea*

Research showed that moretenol had been isolated from the hexane-dichloromethane fraction of crude methanol extract of *F. deltoidea* (Lip et al., 2009). In an *in silico* study, this compound demonstrated notable binding potential against receptors of both Gram-positive and Gram-negative bacteria. Specifically, moretenol exhibited binding affinities of −8.1 kcal/mol with dihydroorotase from *E. coli*, −6.61 kcal/mol with DNA gyrase from *E. coli*, −6.21 kcal/mol with tyrosyl-tRNA synthetase from *S. aureus*, and −8.46 kcal/mol with DNA gyrase from *S. aureus* (Riaz et al., 2023). Since a binding affinity of −9 kcal/mol generally indicates strong interaction with a receptor, these findings suggest that moretenol may exert significant antimicrobial effects against both Gram-positive and Gram-negative bacteria (Hasnat et al., 2023; Taher et al., 2024). In a study by Choo et al., two bioactive flavonoids, vitexin and isovitexin, were isolated from the leaves of *Ficus* deltoidea. These compounds exhibited inhibitory effects on α-glucosidase, an enzyme involved in carbohydrate metabolism, highlighting their potential as natural antidiabetic agents (Choo et al., 2012 Aug 1).

Another report suggested the presence of kaempferol and naringenin in the leaf extract of the species (Abdullah and Chua, 2017). Kaempferol and naringenin are common flavonoids known for a variety of bioactivities, particularly antioxidant, anticarcinogenic, anti-inflammatory, antidiabetic antimicrobial and lipid-lowering activities (Hasnat et al., 2024).

8.2.6. *Ficus exasperata*

Bergapten, oxypeucedanin hydrate and sitosterol-3-O-β-D-glucopyranoside isolated from chloroform extract of the stem bark of *F. exasperata* have possessed antioxidant effect with IC_{50} values of 63.38 ± 0.010, 46.64 ± 0.011 and 220.3 ± 0.03 μg/ ml. Also, they have manifested anti-inflammatory activities with ED_{50} values of 101.6 ± 0.003, 126.4 ± 0.011 and 225.9 ± 0.012 mg/kg respectively (Amponsah et al., 2013). Moreover, (2S,3S,4R,11E)-2-[(2′,3′-dihydroxyhexacosanoylamino)]-11-octadecene-1,3,4-triol also called *Ficus*amide, (S)-(−) oxypeucedanin hydrate and (R)-(−+) oxypeucedanin hydrate isolated from the methanol extract of the stem bark of *F. exasperata* have conveyed antimicrobial activity against some gram negative bacteria like *Citrobacter freundii, E. coli, Shigella dysenteriae, P. aeruginos, K. pneumonia* and *S. typhi*; some gram positive bacteria like *B. cereus, S. aureus* and *Streptococcus faecalis*, and some fungus like *C. albicans* and *Microsporum audouinii* where, (S)-(−) oxypeucedanin hydrate inhibited all of them with Minimal Inhibition Concentration (MIC) values of 625, 156.25, 312.50, 156.25, 312.50, 78.12, 9.76, 78.12, 78.12, 39.06 and 39.06 μg/mL, also (R)-(−+) oxypeucedanin hydrate inhibited all of them with MIC values of 625, 39.06, 312.5, 156.25, 625, 78.12, 9.76, 78.12, 78.12, 39.06 and 39.06 μg/mL, but *Ficus*amide only inhibited *Escherichia coli* with MIC values of 312.50 μg/mL (Dongfack et al., 2012). Similarly, apigenin C8-glucoside and quercetin-3-O-β-rhamnoside isolated from ethanolic extract of the leaves of *F. exasperata* have manifested antimicrobial activity against *S. aureus* and *B. subtilis* with the zone of inhibition of 1.5 and 2.0 mm respectively against *S. aureus* and 1.2 and 2.5 respectively against *B. subtilis* (Taiwo and Igbeneghu, 2014). In addition, α-amyrin acetate isolated from ethyl acetate crude extract of *F. exasperata* has exhibited antioxidant, anti-inflammatory, antihyperglycemic, larvicidal, cytotoxic, antispasmodic, antihepatotoxic, anti-erectile dysfunction, analgesic activity by various studies (Nnamonu et al., 2016).

8.2.7. *Ficus microcarpa*

Some flavonoids like ficuflavoside, (+)-catechin, (−)-epicatechin, isovitexin, luteolin 6-C-β-D-glucopyranoside, and isosaponarin are isolated from methanol extract of the *Ficus microcarpa* leaves have conveyed potent antioxidant activity by oxygen radical absorbance capacity or ORAC method (Van et al., 2011 Jan 15). Additionally, quercetin 3,7-O-α-L-dirhamnoside, 6-Hydroxyluteolin, rutin, cyclohexanecarboxylic acid, 5-O-Caffeoylquinic acid, bergapten, 3,4-Dihydroxybenzoic acid, *p*-Coumaric acid, and caffeic acid have been isolated from methanolic extract of *F. microcarpa* leaves have conveyed antiprotease activity against SARA-CoV-2 virus, which causes COVID-19, a recent pandemic, indeed, quercetin 3,7-O-α-L-dirhamnoside and rutin possessed most robust antiprotease activity against the virus species (Hassan et al., 2020). However, some triterpenes like 3β-acetoxy-25-hydroxylanosta-8,23-diene, oleanonic acid, acetylbetulinic acid, betulonic acid, acetylursolic acid, ursonic acid, ursolic acid, and 3-oxofriedelan-28-oic acid were isolated from the aerial roots of *Ficus microcarpa* have possessed cytotoxicity potential against some human cancer cell lines, namely, HONE-1 nasopharyngeal carcinoma, KB oral epidermoid carcinoma, and HT29 colorectal carcinoma cell, where they showed IC50 values of > 10, 7.2 ± 1.9, 4.7 ± 1.9, 4.9 ± 2.1, >10, 5.2 ± 0.7, 8.8 ± 1.5 and 9.4 ± 2.8 μM respectively, against HONE-1; >10, 6.3 ± 1.6, 6.7 ± 2.6, 8.2 ± 1.8, 8.4 ± 2.9, 4.0 ± 2.1, 8.2 ± 2.7 μM and 8.3 ± 2.4 respectively, against KB, and, 9.3 ± 1.6, >10, >10, >10, >10, 6.3 ± 1.8, 4.7 ± 1.5 and > 10 μM respectively, against HT29 cancer cell lines (Chiang et al., 2005).

8.2.8. *Ficus racemosa*

Racemosic acid or (rel)-4,6-dihydroxy-5-[3-methyl-(E)-propenoic acid-3-yl]-7-β-glucopyranosyl-[2α,3β-dihydrobenzofuran]-(3,2:b)-[4α,5β-dihydroxy-6α-hydroxymethyltetrahydropyran] was isolated from *Ficus racemosa* ethanol extract has shown strong inhibitory activity against COX-1 and 5-LOX with IC_{50} values equal to 90 and 18 μM respectively, as well as, the compound has also shown strong antioxidant activity by scavenge ABTS free radical cation with IC_{50} values equal to 19 μM (Li et al., 2004). Additionally, β-sitosterol-D-glucoside, aloe-emodin, genistein, 1,3,6-trihydroxy-8-methyl-anthraquinone and 3-(1-C-β-D-glucopyranosyl)-2,6-dihydroxy-5-methoxybenzoic acid were isolated from ethanol *Ficus glomerata* wood extract have conveyed nitric oxide (NO) inhibitory activities with IC_{50} values equal to 59.9, 41.8, 27.5, 34.7 and 43.9 μM respectively, in contrast, only aloe-emodin and 1,3,6-trihydroxy-8-methyl-anthraquinone possessed anti-HIV activity, where they inhibited 31.9 ± 3.9 and 19.5 ± 1.2 % HIV-1 virus respectively (Bunluepuech et al., 2011). Also, β-sitosterol, β-amyrin, and lupiol acetate were isolated from the stem bark of *F. glomerata* have manifested hypoglycemic potency by activating glucose-6-phosphate dehydrogenase enzyme with an enzyme activity of 273.20, 212.00 and 239.00 unit/min. At the same time, they increase the enzyme activity by 1.46, 1.13, and 1.27 fold, respectively (Rahman et al., 1994).

8.2.9. *Ficus religiosa*

Some very potential phytochemicals in particular, 4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl, 1,2-Benzenediol, Phenol,2,6-dimethoxy, Methylparaben, Phenol,2,4-bis(1,1–dimethylethyl), Caff eine, Hexadecanoic acid, methyl ester, n-Hexadecanoic acid, Octadecanoic acid, Ergost-5-en-3-ol(3beta), Stigmasterol, Stigmasterol,22,23-dihydro and Lanosta-8,24-dien-3-ol, acetate(3beta) were isolated from methanol stem extract of *Ficus religiosa* by GC–MS analysis. These phytochemicals exhibited various biological potency, to illustrate, 4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl possessed antimicrobial and anti-inflammatory potency; 1,2-Benzenediol possessed anticancer against breast cancer, antioxidant and pesticides potency; Phenol,2,6-dimethoxy possessed antiaggregant and anti-prostaglandin potency; Methylparaben possessed antioxidant potency; Phenol,2,4-bis(1,1–dimethylethyl) possessed antioxidant and antibacterial potency; Caffeine antiviral, CNS stimulant, antitumor, insecticide, pesticide, stimulant, antioxidant and hypoglycemic potency; Hexadecanoic acid and methyl ester possessed antioxidant, hypercholesterolemic and pesticide potency; n-Hexadecanoic acid possessed antioxidant and hypercholesterolemic potency; Octadecanoic acid possessed hypocholesterolemic potency; Ergost-5-en-3-ol(3beta) possessed antioxidant and hypocholesterolemic potency; stigmasterol possessed anti-inflammatory, antioxidant, antiviral and sedative potency; Stigmasterol,22,23-dihydro possessed anticancer against lung, cervix and breast cancer, antioxidant, hypoglycemic, hypocholesterolemic and antiviral potency; finally, Lanosta-8,24-dien-3-ol, acetate(3beta) possessed anti-amylase inhibitor, antimicrobial and anti-diabetic potency (Manorenjitha et al., 2013).

8.2.10. *Ficus sycomorus*

Lupeol acetate was isolated from n-butanolic extract of *Ficus sycomorus* has possessed antimicrobial activity against *S. aureus, B. subtilis,* and *S. typhi*, while 100 μg/mL lupeol acetate showed a zone of inhibition against those microbes equal to 18, 16 and 18 mm, respectively, also the compound showed minimum inhibitory concentration (MIC) values equal to 12.5 μg/mL, as with minimum bactericidal concentration (MIB) values equal to 25 μg/mL against those microbes (Muktar et al., 2018). Also, quercetin, gallic acid, quercetin 3-*O*-L-rhamnopyranosyl(1 → 6)-β-D-glucopyranoside (Rutin), quercetin 3-*O*-β-D-glucopyranoside (Isoquercitrin), quercetin 3,7-*O*-α-L-dirhamnoside and quercetin 3-*O*-β-D-galactopyranosyl(1 → 6)-glucopyranoside were isolated from methanol extract of *Ficus sycomorus* leaves demonstrated antioxidant properties, where these compounds showed SC_{50} values of DPPH free radical scavenging activity equal to 4.07 ± 0.01, 4.80 ± 0.01, 7.79 ± 0.06, 9.25 ± 0.05, 10.01 ± 0.1, 6.95 ± 0.01 μg /ml respectively, as well as, total antioxidant capacity values equal to 772.58 ± 5.59, 690.34 ± 2.56, 463.69 ± 3.38, 321.46 ± 3.40, 266.63 ± 2.22 and 502.20 ± 4.45 mg AAE /g compound, respectively (El-Sayed et al., 2010).

9. Others

Leaves of *F. deltoidea* have been used in commercial tea beverage companies due to their high amount of mineral content like magnesium, manganese and potassium, potassium, sodium, iron, and zinc (Rosnah et al., 2015). In China, figs of *Ficus deltoidea* are commercialized as wine and also used with grape, rice, or powder of dried *Ganoderma lucidum* due to its endowed tasty, unique flavor as well as to promote health. However, Mexican howler monkeys use the species as 64.2 % of their meals. Meanwhile, Ateles chamek monkeys utilize 50 % of their meals (Rosnah et al., 2015). The lye of wood ash of *F. microcarpa* has been used to make kneading wheat, which is further used in famous Okinawan soba noodles (Chan et al., 2017).

10. Discussion

Worldwide, herbal medications are used to treat a wide range of illnesses and diseases (Hasnat et al., 2023; Alam et al., 2024;(August).). While some herbal formulations have undergone *in vitro* and *in vivo* testing, rigorous controlled clinical studies are still rare, which limits objective evidence supporting their therapeutic efficacy. Despite the effectiveness of conventional medicines for certain conditions, the rise in drug resistance is becoming a significant challenge, creating an urgent need for new bioactive compounds derived from natural sources (Malik and Bhattacharyya, 2019; Shahriar et al., 2024)Recent studies have increasingly highlighted the broad therapeutic potential of plants of the genus Ficus, widely used in traditional medicine. Ficus species are traditionally employed to treat diverse ailments, such as diarrhea, inflammation, asthma, liver, and cardiovascular disorders.

The ethnopharmacological significance of *Ficus* species is well-documented across various cultures, where these plants are traditionally used to treat a broad spectrum of ailments, ranging from gastrointestinal and respiratory issues to skin disorders and diabetes. For example, in Nepal, the bark juice and leaf paste of *F. auriculata* are used to address gastrointestinal problems like dysentery, while its latex is employed as an anthelmintic and for wound healing (Shilpakar, 2009). Similarly, *F. benghalensis* is mentioned in Ayurveda for treating a variety of conditions, including gastrointestinal and urinary problems, as well as supporting skin health, diabetes, and conception (Abbafati et al., 2020; Murti et al., 2010). Other species, such as *F. benjamina* and *F. carica*, are widely used for infections, hypotension, skin conditions, and more, reflecting their broad ethnopharmacological applications (Ahmad et al., 2013; Imran et al., 2014; Gilani et al., 2008).

The biological activities of *Ficus* species strongly correlate with their traditional uses, showcasing a direct link between ethnopharmacology and modern pharmacological findings. *F. auriculata*, for example, is commonly studied for its antioxidant and antibacterial properties, with methanolic extracts showing significant antimicrobial effects against pathogens like *E. coli* and *S. typhimurium*, validating its traditional use in treating infections and gastrointestinal issues (Kumari et al., 2018). Similarly, *F. benghalensis* exhibits antimicrobial, antioxidant, and antidiabetic properties, corroborating its use in treating skin diseases, urinary issues, and metabolic disorders (Verma et al., 2015; Aswar et al., 2008; Simonsen et al., 2001; Gayathri and Kannabiran, 2008). *F. carica*, traditionally used for constipation and respiratory ailments, demonstrates anti-inflammatory and neuroprotective effects, while *F. exasperata* has shown promising hypoglycemic and hepatoprotective activities, validating its use in traditional medicine for managing blood glucose levels and liver health (Kingsley, 2013; Adewole et al., 2011).

The connection between the ethnopharmacological uses and the biological activities of *Ficus* species underscores the therapeutic potential of these plants. The diverse phytochemicals found in *Ficus* species, such as flavonoids, terpenoids, and phenolic compounds, are responsible for their antioxidant, antimicrobial, anti-inflammatory, and anticancer properties. For instance, compounds like betulinic acid, lupeol, and stigmasterol in *F. auriculata* exhibit antimicrobial and anti-inflammatory effects, supporting its use in traditional medicine. Likewise, the flavonoids and triterpenes found in species like *F. microcarpa* and *F. benjamina* contribute to their antioxidant and antiviral activities, reflecting the medicinal uses of these plants in traditional healing systems. The synergistic relationship between ethnopharmacology and modern scientific research highlights the importance of *Ficus* species as a promising source of bioactive compounds for drug discovery and the development of natural health products.

Despite these findings, several critical gaps in research remain. Comprehensive double-blind, placebo-controlled clinical trials are essential to validate the efficacy and safety of *Ficus*-based therapies in larger patient populations. Such studies would also allow for an in-depth investigation of the mechanisms of action of active principles within *Ficus* species, including any synergistic interactions among these compounds that may enhance therapeutic effects. Additionally, for the clinical application of *Ficus* plants as standardized phytomedicines, sensitive analytical methods are needed to be developed to ensure consistent quantification and quality control of secondary metabolites in botanical formulations. These steps will be crucial in harnessing the therapeutic potential of *Ficus* plants for safe and effective use in modern medicine.

11. Novelty

This review offers a comprehensive and up-to-date perspective on the genus *Ficus*, distinguishing it from previously published reviews by presenting recent advancements in both phytochemical analyses and pharmacological research. While earlier reviews primarily provided broad overviews of *Ficus* species' traditional uses and general medicinal properties, this article delves deeper into the specific bioactive compounds identified in various *Ficus* species, such as betulinic acid, lupeol, stigmasterol, quercetin, and myricetin. It also highlights advanced analytical techniques, including LC-MS and NMR spectroscopy, that have improved the accuracy of bioactive compound identification, which previous reviews may not have emphasized in depth.

Moreover, this review brings forward recent pharmacological studies that reveal specific activities of *Ficus* species against pathogens and chronic disease markers, such as oxidative stress and inflammation. It also underscores the potential for *Ficus* species to be explored as sources of novel drug candidates, offering detailed insights into mechanisms of action and synergistic interactions among compounds that have not been comprehensively addressed in earlier publications. Furthermore, by discussing the critical need for standardized clinical trials and sensitive analytical methods, this article provides a future-oriented roadmap for translating *Ficus*-based traditional medicine into evidence-backed therapeutic applications. This approach not only updates the current scientific understanding of *Ficus* species but also highlights their relevance to modern medicinal research, enhancing the practical and clinical significance of this review compared to past works.

12. Conclusion

Natural products are a vital source of new drugs, with many medications stemming from this highly-esteemed wellspring. The expanding use of herbal medicines in conventional treatments emphasizes the need for new phyto sources to heal different health discomforts. Ethnopharmacological use of *Ficus* plants, ranging from antioxidant and anti-inflammatory to antibacterial, larvicidal, and several other actions, deciphered remarkable medicinal promise and validated their candidacy to be the lead compound for new drug development and discovery. However, Comprehensive double-blinded clinical trials are still needed to evaluate these botanical preparations' efficacy and analyze side effects from a molecular level perspective before they may be used in clinical practice with an explicit knowledge of the mode of action. In addition, sensitive analytical methods for standardization of *Ficus*-derived secondary metabolites are needed to ensure their purity and consistency in therapeutic applications.

CRediT authorship contribution statement

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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