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Antioxidant Properties of Ficus Species – A Review

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Abstract: Ficus is a huge tropical ,deciduous , evergreen tree with more than 800 species . Bark , root , leaves , fruit and latex of this plant are frequently usedfor the treatment of various illnesses. Ficus produces a unique fruit which is actually a inverted flower. Ficus species are rich source of polyphenolic compounds , flavanoids which are responsible for strong antioxidant properties that help in prevention and therapy of various oxidative stress related diseases such as neurodegenerative and hepatic diseases. The present review correlates antioxidant activity of Ficus species with its pharmacological activities.
Key words : *Ficus* species, Free radicals, Polyphenols , flavanoids , Antioxidant property.

Introduction

Ficus, the fig genus, consists of over 800 species and is one of about 40 genera of the mulberryfamily. The fig species of greatest commercial importance is Ficus carica L. (the common fig). Other notable species of Ficus are Ficus religiosa L. (the Bo tree which sheltered the Buddha as he divined the "Truths"), Ficus elastic Roxb. ex Hornem. (the rubber tree), Ficus benghalensis L. (the banyan tree) and Ficus racemosa L. (syn. glomerata, the giant cluster tree). All Ficus spp. possess latex-like material within their vasculatures, affording protection and self-healing from physical assaults [1].

Taxonomy of Ficus
Domain : Eukaryota
Kingdom : Plantae
Subkingdom : Viridaeplantae
Phylum : Tracheophyta
Subphylum : Euphyllophytina
Infraphylum : Radiatopses
Class : Magnoliopsida
Subclass : Dilleniidae
Superorder : Urticanae
Order : Urticales
Family : Moraceae

Genus : Ficus

Various species of Ficus are [2]–
Ficus altissima (council tree)
Ficus aspera (clown fig)
Ficus auriculata, syn. Ficus roxburghii
Ficus benghalensis (Indian banyan)
Ficus benjamina (weeping fig)
Ficus benjamina 'Exotica'
Ficus benjamina 'Comosa'
Ficus binnendykii (narrow-leaf ficus)
Ficus carica (common edible fig)
Ficus celebinsis (willow ficus)
Ficus deltoidea (mistletoe fig) syn. Ficus diversifolia
Ficus elastica (Indian rubber tree)
Ficus elastica 'Abidjan'
Ficus elastica 'Asahi'
Ficus elastica 'Decora'
Ficus elastica 'Gold'
Ficus elastica 'Schrijveriana'
Ficus lacor (pakur tree)
Ficus lingua (box-leaved fig) syn. Ficus buxifolia
Ficus lyrata (fiddle-leaf fig)
Ficus macrophylla (Moreton Bay fig)
Ficus microcarpa (Chinese banyan)
Ficus microcarpa var. crassifolia (wax ficus)

Ficus microcarpa 'Variegata'
Ficus pseudopalma (Philippine fig)
Ficus pumila (creeping fig) syn. Ficus repens
Ficus religiosa (bo tree or sacred fig)
Ficus rubiginosa (Port Jackson fig or rusty fig)
Ficus rubiginosa 'Variegata' Ficus sagittata 'Variegata',
syn. Ficus radicans 'Variegata'
Ficus saussureana, syn. Ficus dawei
Ficus stricta
Ficus subulata, syn. Ficus salicifolia
Ficus tikoua (Waipahu fig)

Chemical constituents

Ficus species contain flavanoid glycosides , alkaloids , phenolic acids , steroids , saponins , coumarins , tannins , triterpinoids – oleanolic acid , rusolic acid , α-hydroxy ursolic acid , protocatechuic acid , maslinic acid . The nonenzymatic constituents include phenolic compounds , flavanoids , vitamin C . The enzymatic constituents present are ascorbate oxidase , ascorbate peroxidise , catalase , peroxidise . The phenolic compounds present are gallic acid and ellagic acid . Furanocoumarins that are reported are psoralen , bergapten .[3]

β-sitosterol and a new tetracyclic tritepene – glaunol acetate are reported from the leaves , bark and heartwood of F.palmata . Besides , ceryl behenate , lupeol , α-amyrin acetate are reported from the stem bark of F.palmata . Taraxasterol tiglate in heartwood , quercitin-3-glucoside, rutin from leaves and three new methyl ethers of leucoanthocyanins (delphinidin-3-o-α- L-rhamnoside , pelargonidin-3-o-α-L-rhamnoside , leucocyanidin-3-o-β-D-glactosyl cellobioside) , methyl ether of leucoanthocyanidin , 20-tetra triaconten-2-one , pentatriacontan-5-one , 6-heptatriaconten-10-one , β-sitosterol-α-D-glucoside , meso-inositol were reported from the stem bark of F.benghalensis [3],[4].

Triterpinoid constituents rhoiptelenol , 3α-hydroxy-isohop-22(29)-en-24-oic acid were isolated from the methanolic extracts of fresh leaves and stems of Ficus thumbergii . This species also contains lupenyl acetate , β-amyrin acetate , α-amyrin acetate , lupeol , β-amyrin , α-amyrin , glutinol , ursolic acid, betulinic acid in its leaves and stems [5].

Besides the leaves , bark and fruits of F.benjamina contains cinnamic acid , lactose , naringenin , quercetin , caffeic acid , stigmasterol [6].

Two new pentacyclic triterpenes 8,26-cyclo-urs-21-en-3β,20β-diol and 3β-acetoxy-8,26-cyclo-ursan-20β-ol and also 3-friedelanone, oleanolic acid, betulinic acid, lupeol acetate, α and β amyrine, 3,5,7,4'-tetra hydroxyl flavones, 3,5,7,3',4'-pentahydroxy flavanate are reported from the stem bark of Ficus cordata [7].

4, 4, 24-trimelhyl-cholesta-8-en-3-B-ol, mixture of campesterol, stigmasterol and sitosterol, stigmasterol 3-B-o`glucoside and 4, 5, 7-trihydroxy flavan-3-ol. In addition to xantholoxin, $-amyrin and "-amyrin from n-hexane and ethyl acetate fractions of ethanol extract of Ficus capensis (Thunb) leaves [8].

Uses of Ficus species

Fresh juice(50-100 ml) of leaves of Ficus racemosa L. is given with water for about 10 days to treat gastrointestinal problems [9].

Bark of Ficus arnottiana and F.hispida shows hypoglycaemic activity [10,11].

Roots of Ficus bengalensis shows anthelmintic activity. The extracts also reported to inhibit insulinase activity from liver and kidney. Fruit extracts exhibits anti-tumour activity [12].

Various pharmacological actions such as anti-ulcer, anti-diabetic, lipid lowering and antifungal activities have been described for F. exasperata. Ethanolic leaf extract of F.exasperata shows anti-bacterial activity [13]. Leaves exhibit hypotensive activity [14].

Ethanolic and aqueous wood extracts of F.glomerata shows Anti-HIV- 1 integrase activity[15].

Ficus religiosa is reported to have numerous therapeutic uses in folk medicine. Leaf juice has been used for the treatment of asthma, cough, sexual disorders, diarrhoea, haematuria, ear-ache and toothache, migraine, eye troubles, gastric problems and scabies; leaf decoction has been used as an analgesic for toothache; fruits for the treatment of asthma, other respiratory disorders and scabies; stem bark is used in gonorrhea, bleeding, paralysis, diabetes, diarrhea, bone fracture, antiseptic, astringent and antidote. In Ayurveda it is claimed that Ficus religiosa possesses anticonvulsant activity. Many such reports had been validated pharmacologically for its actions on CNS . Different parts of Ficus religiosa showed acetyl cholinesterase inhibitory activity and antianxiety activity. Figs (fruits) of this plant contain numerous amino acids like asparaginase and tyrosine in fruit edible part, alanine, threonine, tyrosine and valine in seeds, alanine and valine in proteins. The methanolic extract of figs of Ficus religiosa had anticonvulsant activity [16].

The fruit extracts of F. sycomorous L., F. benjamina L., F.bengalensis L. and F.religiosa L. exhibit anti tumour activity and anti bacterial activity, but no anti fungal activity [17].

Fresh and dried fruit of F.carica is used in cancer, carcinoma, ulcers, hepatomegaly, spleenomegaly. Latex is used in ulcers and gout. Leaves are used in cancer, tumours, dermatitis. Latex of F.racemosa is used as aphrodisiac and bark powder is used in diabetes, ulcers, hiccups, gonorrhoea and fruits are used as laxative and digestive.

Fruit of F.carica shows spasmolytic activity, mediated through the activation of K^+-ATP channels along with anti platelet activity. Hence, it can be used in gut motility and inflammatory disorders [18].

Oxidative stress and role of antioxidants

Oxidation refers to transfer of electrons from a substance to an oxidizing agent. Oxidation reactions results in free radicals ,which immediately start chain reactions that result in damage to the living cells [19].

Metabolism in majority of complex living organisms requires oxygen for its survival .But, oxygen being, a highly reactive molecule damages living organisms by producing reactive oxygen species [20] . These reactive oxygen species produced in the living cells include hydrogen peroxide (H_2O_2) , hypochlorous acid (HOCl) and free radicals such as the hydroxyl radical (·OH) and the superoxide anion (O_2^-) [21] .

The hydroxyl radical is unstable and will react rapidly and non-specifically with most of the biological molecules . These oxidant damage the cells by starting chemical chain reactions such as lipid peroxidation , or by oxidizing DNA or proteins [22].

Damage to DNA result in serious problems, possibly cancer, if not reversed by DNA repair mechanisms [23]. Damage to proteins result in enzyme inhibition , denaturation and protein degradation [24].

During metabolism, the use of oxygen generates highly reactive species such as the superoxide anion which is produced as a by-product of several steps in the electron transport chain [25]. The reduction of coenzyme Q in complex III, results in the formation of highly reactive free radical as an intermediate ($Q\cdot^-$). This intermediate, being unstable results in electron "leakage", where the electrons jump directly to oxygen and form the superoxide anion, instead of moving through the normal series of well-controlled reactions of the electron transport chain [26].

An **antioxidant** is a molecule that slows or prevents the oxidation of the molecules. Antioxidants terminate these chain reactions by removing free radical intermediates and inhibit other oxidation reactions by being oxidized themselves. As a result, antioxidants are often considered as reducing agents such as thiols, ascorbic acid , polyphenols [19].

Antioxidants are classified into two broad divisions, depending on whether they are soluble in water (hydrophilic) or in lipids (hydrophobic) . In general, water-soluble antioxidants react with oxidants in the cell cytosol and the blood plasma, while lipid-soluble antioxidants protect cell membranes from lipid peroxidation [19].

Although oxidation reactions are essential for survivals, they can also be damaging. Hence, plants and animals maintain complex systems of multiple types of antioxidants, such as glutathione, vitamin C, and vitamin E as well as enzymes such as catalase, superoxide dismutase and various peroxidases. Low levels of antioxidants or inhibition of the antioxidant enzymes, cause oxidative stress and may damage or kill the living cells.

As oxidative stress is an important part of many human diseases, the use of antioxidants in pharmacology is intensively studied, particularly in the treatment of stroke and neurodegenerative diseases.Antioxidants are widely used as ingredients in the dietary supplements in order to maintain health and to prevent diseases such as cancer and coronary heart disease [27].

These compounds may be synthesized in the body or obtained from the diet [28].The different antioxidants are present at a wide range of concentrations in body fluids and tissues , some such as glutathione or ubiquinone mostly present within the cells, while others such as uric acid are more evenly distributed .

The action of an antioxidant thus depends on the proper function of other members of the antioxidant system. The extent of protection provided by any one antioxidant also depends on its concentration, its reactivity towards the particular reactive oxygen species and the status of the antioxidants with which it interacts [28].

Some compounds contribute to antioxidant defense by chelating transition metals and preventing them from catalyzing the production of free radicals in the cell. Selenium and zinc are commonly referred as antioxidant nutrients [29].

Antioxidant protection system in biological system [30]

Endogenous Antioxidants

- Bilirubin
- Thiols, e.g., glutathione , lipoic acid, N-acetyl cysteine
- NADPH and NADH
- Ubiquinone (coenzyme Q10)
- Uric acid
- Enzymes:

– copper/zinc and manganese-dependent superoxide dismutase (SOD)
– iron-dependent catalase
– selenium-dependent glutathione peroxidise

Dietary Antioxidants

- Vitamin C
- Vitamin E
- Beta carotene and other carotenoids and oxycarotenoids,

e.g., lycopene and lutein

- Polyphenols,

e.g., flavonoids, flavones, flavonols, and Proanthocyanidins

Metal Binding Proteins
- Albumin (copper)
- Ceruloplasmin (copper)
- Metallothionein (copper)
- Ferritin (iron)
- Myoglobin (iron)
- Transferrin (iron)

Assay methods for antioxidants [31-43]

ABTS (2,20-azinobis (3-ethylbenzothiazoline-6-sulfonate) assay or TEAC (The Trolox equivalent antioxidant capacity) assay
DPPH (1,1-diphenyl-2-picrylhydrazyl radical) method
FRAP (Ferric reducing ability of plasma) assay
ORAC (The oxygen radical absorbance capacity) assay
TRAP (The total radical trapping parameter) assay
DCFH-DA (Dichlorofluorescin-diacetate) based assay
Cyclic voltammetry method
TOSC (total oxyradical scavengingcapacity) assay
PCL (Photochemiluminescence) assay
Crocin CL test assay (crocin chemoluminescence assay)
Chronocoulometric assay
CAA assay (Cellular antioxidant activity)
Conjugated diene assay
Superoxide radical scavenging activity
Hydroxyl radical scavenging activity
Nitric oxide radical inhibition activity
Reducing power method
Phospho molybdenum method
Peroxynitrile radical scavenging activity
β-carotene linoleate method
Xanthine oxidase method
Cytochrome C test
Erythrocyte ghost system
Microsomal lipid peroxidation or Thiobarbituric acid (TBA) assay

Antioxidant Properties of various Ficus Species

The methanol extracts prepared from bark, fruits and leaves of F. microcarpa exhibited strong antioxidant activity assayed by the four different methods including DPPH and $ABTS^{\bullet+}$ free radicals scavenging, PMS–NADH system superoxide radical scavenging and β-carotene–linoleic acid system. The methanol extract of bark showed stronger antioxidant activity than those of leaves and fruits in $ABTS^{\bullet+}$, PMS–NADH and β-carotene/linoleic acid system . The antioxidant activity is mainly due to the presence of phenolic compounds and hence the bark contains high level of phenolic compounds. The methanol extract of bark also exhibited anti bacterial activity against Gram positive and Gram negative bacteria . This antibacterial activity is mainly due to the presence high level phenolic compounds. Various researches carried out on F.microcarpa reported the presence of several triterpenoids such as oleanolic acid , rusolic acid , α-hydroxy ursolic acid , protocatechic acid and maclinic acid in the fruits , aerial roots and bark . It has been shown that ursolic acid , oleanolic acid and other triterpenoids are efficient protectors against lipid peroxidation and hence these are potent antioxidants [44].

The antipyretic and analgesic action of Ficus microcarpa is due to its antioxidant activity.

The aqueous extract of dried bark of Ficus glomerata exhibited dose dependent antioxidant activity, evaluated by site specific and non site specific antioxidant activity. The extract has shown presence of flavonoids, phenolics, terpenoids, carbohydrates and alkaloids.The antioxidant activity may be attributed to flavonoids and phenolics present in the drug [45].

The antioxidant effect of aqueous extract of the bark of Ficus bengalensis Linn. Root has been evaluated for its free radical scavenging activity, reducing capacity and hydrogen peroxide activity. These studies have shown that the antioxidant properties are mainly due to the presence of phenolic compounds [46].

Besides phenolic acid compounds, flavanoid glycosides with antioxidant properties have been reported from the 50% aqueous ethanolic leaf extract of Ficus pumila.

The flavonoid glycosides which are isolated and identified are rutin , apigenin 6-neohesperidose , kaempferol 3-robinobioside and kaempferol 3-rutinoside.Among these compounds, rutin exhibited the strongest antioxidant activity. These results show that Ficus pumila leaves serve as a good natural source of antioxidants [47].

Metabolite profiling performed on the leaves, pulps and peels of two Portuguese white varieties of F.carica (Pingo de Mel and Branca Tradicional) showed the presence of phenolics and organic acids . Phenolic compounds include 3-O- and 5-O-caffeoylquinic acids, ferulic acid, quercetin-3-O-glucoside, quercetin-3-O-rutinoside, psoralen and bergapten. Organic acids in leaves include oxalic, citric, malic, quinic, shikimic and fumaric acids. Pulps and peels contains the same with the exception of quinic acid. Pulp contains highest amount of chlorgenic acid. Quercitin-3-O-rutinoside content in peels is significantly higher than in pulp and peels. Psoralen occurred in pulps at significantly higher levels when compared to peels. Psoralen and bergapten (5-methoxypsoralen) are two photoactive furanocoumarins reported in F. carica leaves. These compounds, especially psoralen, are utilized along with UV radiation in the treatment of skin conditions, such as skin depigmentation (psoriasis and vitiligo),

mycosis fungoides, polymorphous dermatitis and eczema. All the three vegetal materials exhibited antioxidant properties due to the presence of phenolic compounds. Leaves possess the strongest antioxidant potential and pulps the weakest one. These facts may be explained by the highest amounts of phenolic compounds occurring in leaves.

The antioxidant capacity of phenolic compounds is based on their ability to scaveng free radicals, chelate pro-oxidant metal-ions and to inhibit some enzymes. The total phenolic content is significantly different among the three vegetal materials, following the order : leaves ≫ peels ≫ pulps.

Leaves may constitute an e xcellent dietary and economical source of bioactive compounds, namely, phenolics. The consumption of this fruit may prevent the diseases in which homeostasis is impaired by oxidative features. In addition, as leaves are characterized by higher quantities of psoralen and bergapten , their use by cosmetic and pharmaceutical industries for the treatment of some dermatological diseases, such as psoriasis and vitiligo [48].

The antioxidant activities of both non enzymatic and enzymatic constituents present in both male (leaf with red spots) and female (leaf with black spots) are studied. The non enzymatic constituents include phenolic compounds, flavanoids, vitamin C. The enzymatic constituents include ascorbate oxidase, peroxidise, catalase and ascorbate peroxidise. The aqueous leaf extracts of female plants of F.deltoidea shows higher antioxidant activity than male leaves, which indicates that both enzymatic and non enzymatic constituents are higher in female plant leaves.

Ascorbate peroxidise activities are found to be higher in the leaves' extracts than in the roots and stems' extracts, which suggested that ascorbate peroxidise is mainly located in the chloroplast of leaves [49].

Pharmacological activity of Ficus species with respect to their antioxidant properties

As a Natural Radioprotector

Ethanol extract (FRE) and water extract (FRW) of Ficus racemosa are subjected to free radical scavenging. FRE exhibited significantly higher steady state antioxidant activity than FRW. FRE exhibited concentration dependent DPPH, ABTS, hydroxyl radical and superoxide radical scavenging and inhibition of lipid peroxidation. So, FRE is selected to study the invitro radioprotection in Chinese hamster lung fibroblast cells. The radioprotective activity was determined by 'Invitro Cytokinesis blocks Micronucleus Assay' where the fibroblast cells exposed to γ-radiation.

Exposure of fibroblast cells to γ-radiation results in damage to DNA and membrane lipids , thereby reproductive cell death. There is a correlation between the induction of

cell death and frequency of micronuclei induction and chromosome aberrations. Therefore micronucleus assay is a useful parameter to assess the cytogenetic damage.

It is extensively used to screen the cytoprotective/radiomodifying potential of synthetic and natural products.

The results of in vitro antioxidant data showed a significant free radical scavenging activity of FRE in a dose dependent manner. Such free radical scavengers exert a key role in radioprotection, because radiation induced cytotoxicity is mediated mainly through generation of free radicals in the biological system.Thus , antioxidant effect of FRE makes an important contribution to radioprotective potential [50].

As an Hypocholesterolaemic

The antioxidant effect of aqueous extract of the bark of **Ficus bengalensis** has been evaluated in hypercholesterolaemic rabbits. Rabbits are made hypercholesterolaemic by feeding cholesterol. As a result, serum cholesterol, triacylglycerol and LDL+VLDL levels are increased.

Hypercholesterolaemia leads to increased production of oxygen-free radicals (OFR), which exert their cytotoxic effect by causing lipid peroxidation, depress the antioxidant defences. Administration of aqueous extract of the plant to the hypercholesterolaemic rabbits decrease the levels of lipid peroxidation products by scavenging free radicals like superoxide anion, hydroxyl and peroxy . Decreased lipid peroxidation products is due to the increased availability of antioxidants from aqueous bark extract of Ficus bengalensis. Thus, aqueous extract of bark of Ficus bengalensis due to its antioxidant properties lowers cholesterol levels [51].

As a Gastroprotective

The gastroprotective effect of 50% ethanolic extract of Ficus glomerata fruit has been studied.

Gastric ulcer is mainly due to damage of gastric muscosa by free radicals and reactive oxygen species.

50% ethanolic extract of F.glomerata fruit, because of its antioxidant properties acts as a scavenger of free radicals and thus protects the gastric mucosa from the deleterious effects of free radicals.

Thus, F.glomerata serves as a gastroprotective.

The phenolic compounds (gallic acid and ellagic acid) present in 50% ethanolic extract of F.glomerata fruit serves as antioxidants and hence exhibits gastroprotective activity.

The phenolic agents serve as anti ulcerogenic, antimutagenic and anti cancerogenic compounds [52].

As an Anti ulcerogenic

Anti ulcerogenic activity of methanolic root extract of Ficus hispida Linn. has been studied. It was correlated with the antioxidant properties of Ficus hispida. Anti ulcer effect of Ficus hispida is due its cytoprotective nature of antioxidant constituents [53].

Similarly, anti ulcerogenic activity of methanolic leaf extract of Ficus arnottiana has been studied. The results have shown that F. arnottiana leaf methanolic extract possesses gastroprotective activity, as evidenced by its significant inhibition in the formation of ulcers induced by ethanol. It has muco-protective activity and gastric antisecretary.

As flavonoids have been identified in the methanolic extract, the anti-ulcer activity of this extract is due to the antioxidant activity of the extract [54].

Antioxidant activity of Ficus hispida against azathioprine induced liver injury

The antioxidant effect of methanolic leaf extract of Ficus hispida against azathioprine induced liver injury has been evaluated. The azathioprine (AZA) toxicity in liver proceeds through the extensive generation of reactive oxygen species (ROS). The DPPH radical scavenging and nitric oxide radical inhibiting ability of Ficus hispida shows that the extract exerts a beneficial action against free radical mediated oxidative changes. AZA decreases the levels of antioxidants. The biologically active antioxidant phytoconstituents found in Ficus hispida extract spared the antioxidant activity and reduced the consumption of endogenous antioxidants, which could be responsible for the reduction of AZA induced oxidative stress. Thus, Ficus hispida Linn. leaves possess definite antioxidant and antiperoxide activities against the peroxide-antioxidant imbalance elicited by azathioprine. Thus Ficus hispida can be used in liver ailments [55].

As an Anti inflammatory agent

Anti inflammatory and analgesic effect of aqueous and methanolic bark extract of Ficus bengalensis has been evaluated. The methanolic extract shows significant anti inflammatory potential as compared to the aqueous extract.

The anti inflammatory activity is mainly due to its antioxidant and lysosomal membrane stabilising effects of Ficus bengalensis. The flavanoids and tannins in the methanolic extract are responsible for the anti inflammatory activity through their effect on oxidative stress and membrane stabilisation [56], [57].

As an Hepatoprotective

The methanol extract of the leaves of Ficus carica Linn. has been evaluated for hepatoprotective activity in rats. The test animals when treated with toxic doses of carbon tetrachloride have markedly elevated the levels of serum aspartate aminotransferase, alanine aminotransferase, total serum bilirubin, indicating acute hepatocellular damage. The CCl_4 is converted into reactive metabolite, halogenated free radical by hepatic cytochrome P450s, which in turn covalently binds to cell membrane and organelles to elicit lipid peroxidation with subsequent tissue injury. High lipid peroxidation values indicate excessive free radical induced peroxidation. The measurement of lipid peroxide is also a marker of hepatocellular damage. Methanolic extract of leaves of Ficus carica prevent the rise in lipid peroxides, by its antioxidant effect thereby acting as a hepatoprotective.

The decrease in lipid peroxides may be due to the antioxidant effect of the extract. A possible mechanism of the F. Carica extract as hepatoprotective may be due to its anti-oxidant effect or inhibition of cytochrome P450s which impair the bioactivation of CCl_4 into their corresponding reactive species. The presence of steroids / triterpenoids and their glycosides and coumarins in the methanolic extract of leaves of F. Caric are responsible for antioxidant activity and hence hepatoprotectivity. Since coumarins have hepatoprotective activity , it may be speculated that these constituents of Ficus are responsible for the observed protective effects [58].

Conclusion

Thus, Ficus species are rich source of naturally occurring antioxidants of which phenolic compounds and flavanoids play a vital role in preventing innumerable health disorders related to oxidative stress including cardiovascular diseases, neurodegenerative diseases and cancer. Ficus species due to their strong antioxidant and biological properties are also known to diffuse the toxic free radical and can be used as a possible food additive or in nutraceutical and biopharmaceutical industries.

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