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A Review on Phenolic Compounds from Family Sapotaceae

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Abstract

Sapotaceae is a family of flowering plants that known with wide range of chemical constituents like saponins, flavonoids and poly phenolic compounds. Phenolic compounds are widely distributed in plant kingdom and have several biological activities as anti-inflammatory, antioxidant, antibacterial, antifungal, antidiabetic and antiulcer. This review focuses on the phenolic compounds identified in different species of family sapotaceae and their biological activities.

Keywords: Sapotaceae, Phenolic compounds, Flavonoids, Anti-ulcer, Anti-inflammatory, Antidiabetic

Introduction

Phytochemicals are defined as the substances found in plants that exhibit a potential for modulating human metabolism in a manner beneficial for the prevention of chronic and degenerative diseases [1]. Phenolics are defined as a class of polyphenols which are important secondary metabolites present in plants [2] and are also responsible for their antioxidant action and various beneficial effects in a multitude of diseases [3, 4]. Sticky and often white latex is found in cuts of bark, branches, leaves and fruits, although it often appears slowly in species growing in dry conditions [5].

The Sapotaceae is a family of flowering plants, belonging to order Ericales and divided into five tribes with 53 genera and about 1250 species. It consists of trees or shrubs with a world-wide distribution, although the highest species diversity is found in the tropical and subtropical regions of Asia and South America [5, 6]. Several species produce edible fruits, with or without economic uses. Species noted for their edible fruits include *Manilkara* (Sapodilla, sapota), *Chrysophyllum cainito*, *Pouteria*, and *Planchonia careya*.

Phenolic Compounds isolated from different species

***Manilkara zapota*:** is reported to contain phenolic compounds such as: Myricetin-3-O- α -L-rhaminopyranoside, Apigenin-7-O- α -L-rhamnopyranoside and Caffeic acid, which isolated from leaves [7], Quercetin, (+)-catechin, (-)-epicatechin, (+)-gallo catechin, Gallic acid, dihydromyricetin, Methylchlorogenate, Methyl-4-O-galloyl chlorogenate, 4-O-galloylchlorogenic acid which isolated from fruits [8]. D-quercitol was reported in seeds and leaves [9]. Three phenolic compounds isolated from the fruits of *Manilkara zapota*; Leucodelphinidine, Leucocyanidine, Leucoperalgonidine [10].

***Argania spinosa*:** The phenolic compounds identified in *Argania spinosa* seed oil (Argan oil) are Myricetin-3-O- β -D-galactopyranoside, Myricetin, Quercetin, Myristin, Quercetin, Hesperidin, Rutin, (+)-Catechin, (-)-Epicatechin, Caffeic acid, Ferulic acid, p-hydroxybenzoic acid, Syringic acid, Vanillic acid, Veratric acid, Gallic acid, Naringenin-7-O-glucoside and Luteolin [11].

***Pouteria torta*:** is a species of family sapotaceae, Myricetin-3-O- α -L-arabinopyranoside, Myricetin-3-O- β -D-galactopyranoside, and Myricetin-3-O- α -L-rhaminopyranoside were isolated from leaves [12].

***Pouteria campechiana*:** was studied for the phenolic contents of the leaves to identify; Myricetin-3-O- α -L-arabinopyranoside, Myricetin-3-O- α -L-rhaminopyranoside, Quercetin-3-O- α -L-rhamnopyranoside, Taxifolin-3-O- α -L-rhamnopyranoside, Trans-taxifolin-3-O- α -L-arabinopyranoside, Taxifolin-3-O- α -L-arabinofuranoside and Quercetin-3-O- β -

Arabinopyranoside [13].

Pouteria sapota: (+)-Catechin, (-)-Epicatechin, Gallic acid catechin-3-O-gallate, and myricetin and Gallocatchin-3-O-gallate were isolated from the fruits of *Pouteria sapota* [14, 15].

The presence of dihydromyricetin and (+)-Catechin-3-O-gallate in three species of *Pouteria*; *Sapota*, *viridis* and *campechiana* were reported [16].

Pouteria obovata: fruits contain 2R,3R-4'-O-methyl dihydrokaempferol 7-O-[3''-O-acetyl]- β -D-glucopyranoside; 2R,3R-4'-O-methyl dihydrokaempferol 7-O- β -D- β -L-xylopyranosyl-(1''' \rightarrow 6''')-[3''-O-acetyl]- β -D-glucopyranoside and 2R,3R-4'-O-methyl dihydrokaempferol 3-O- β -D- β -L-xylopyranosyl-(1''' \rightarrow 6''')-[3''-O-acetyl]- β -D-glucopyranoside [17].

Stem bark of *Vitellaria paradoxa* contain quercetin, (+)-Catechin and (-)-Epicatechin [18].

Other species of family Sapotaceae

Fruits and seeds of *Mimusops manilkara* studied for phenolic compounds, quercetin, dihydroquercetin [19].

Myricetin-3-O- α -L-rhaminopyranoside was reported in *Chrysophyllum albidum* [20].

Tridesmostemon omphalocaroides reported the presence of (-)-Epicatechin and lichexanthone in stem wood [21].

Synsepalum dulcificum stem was reported to contain p-hydroxybenzoic acid, Syringic acid, Vanillic acid, Veratric acid, Gallic acid, trans-p-Coumaric acid and cis-p-Coumaric acid [22].

Gallic acid, quercetin and Kampferol were identified in *Mimusops elengi* flower [23].

3', 4'-dihydroxy-5, 2'-dimethoxy-6, 7-methylen dioxy Isoflavone was isolated from *Madhuca latifolia* fruits [24].

Table 1: Flavonoids compounds isolated from family Sapotaceae

Compound	Structure(s)				Species(s)
	R1	R2	R3	R4	
Myricetin-3-O- α -L-arabinopyranoside	O-ara	OH	OH	OH	<i>Pouteria torta</i> <i>Pouteria campechiana</i>
Myricetin-3-O- β -D-galactopyranoside	O-gal	OH	OH	OH	<i>Pouteria torta</i> <i>Argania Spinosa</i>
Myricetin-3-O- α -L-rhaminopyranoside	O-rha	OH	OH	OH	<i>Pouteria torta</i> <i>Manilkara zapota</i> <i>Chrysophyllum albidum</i> <i>Pouteria campechiana</i>
Myricitin	OH	OH	OH	OH	<i>Argania Spinosa</i>
Quercetin	OH	OH	OH	H	<i>Argania Spinosa</i> <i>Mimusops Manilkara</i> <i>Vitellaria paradoxa</i>
Myristrin	O-rha	OH	OH	OH	<i>Argania Spinosa</i> <i>Manilkara zapota</i>
Quercetin-3-O- α -L-rhamnopyranoside	O-rha	H	OH	OH	<i>Argania Spinosa</i> <i>Manilkara zapota</i> <i>Mimusops manilkara</i> <i>Pouteria campechiana</i>
Quercetin-3-O- β -arabinopyranoside	O-ara	H	OH	OH	<i>Pouteria campechiana</i>
Rutin	O-glu-rha	H	OH	OH	<i>Argania Spinosa</i>
Luteolin	H	OH	OH	H	<i>Argania Spinosa</i>

Table 2: Different groups of compound isolated from family Sapotaceae

Compound	Structure(s)	Species(s)
2R,3R-4'-O-methyl dihydrokaempferol 7-O-[3''-O-acetyl]- β -D-glucopyranoside		<i>Pouteria obovata</i>

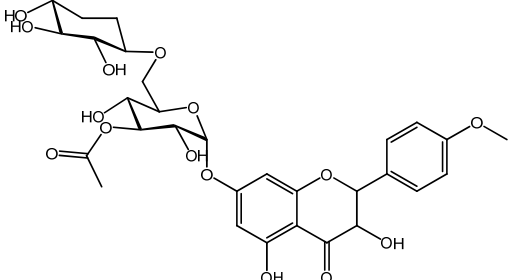
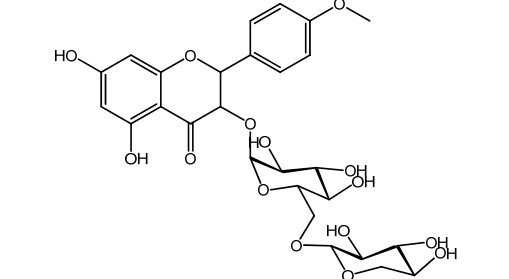
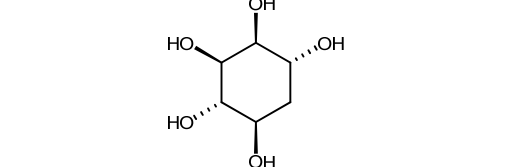
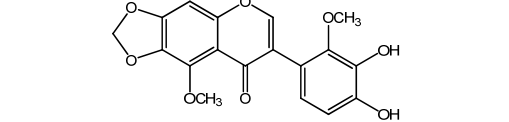
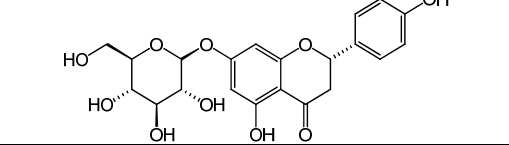
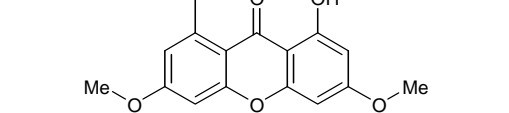
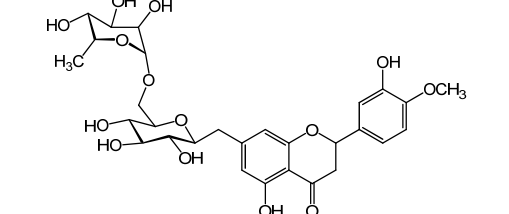
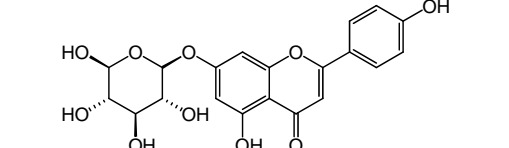
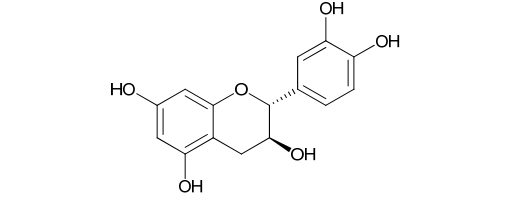
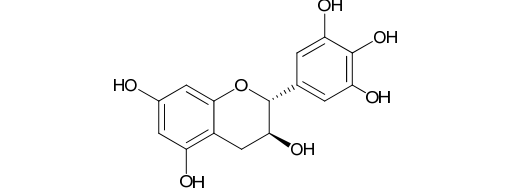
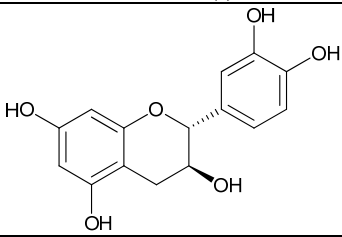
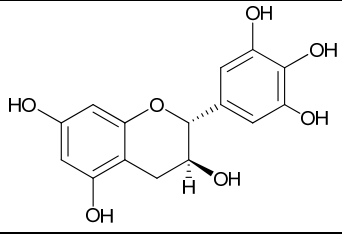
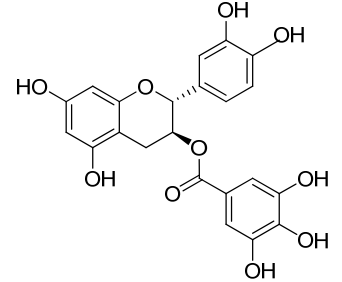
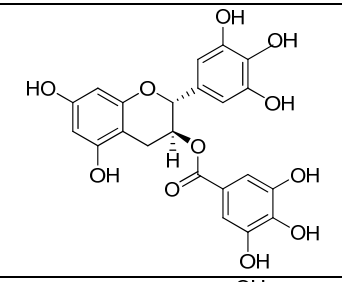
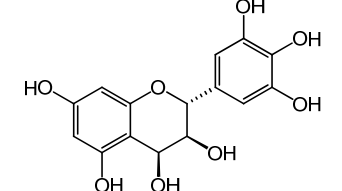
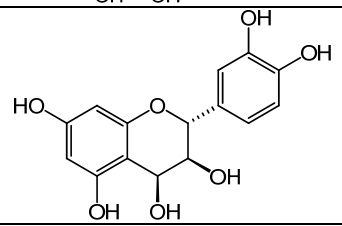
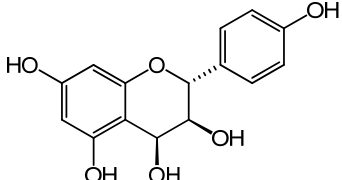
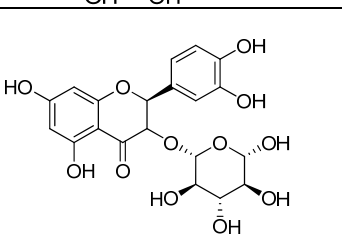
2R,3R-4'-O-methyl dihydrokaempferol 7-O-β-D-β-Lxylopyranosyl-(1'''→6'')-[3''-O-acetyl]-β-D-glucopyranoside		<i>Pouteria obovata</i>
2R,3R-4'-O-methyl dihydrokaempferol 3-O-β-D-β-Lxylopyranosyl-(1'''→6'')-[3''-O-acetyl]-β-D-glucopyranoside		<i>Pouteria obovata</i>
D-quercitol		<i>Manilkara zapota</i>
3',4'-dihydroxy-5,2'-dimethoxy-6,7-methylen dioxy Isoflavone		<i>Madhuca latifolia</i>
Naringenin-7-O-glucoside		<i>Argania Spinosa</i>
Lichexanthone		<i>Tridesmostemon omphalocarpoides</i>
Hesperidin		<i>Argania Spinosa</i>
Apigenin-7-O-α-L-rhamnoside		<i>Manilkara zapota</i>
Dihydroquercetin		<i>Mimusops Manilkara</i>
Dihydromyricetin		<i>Manilkara zapota Pouteria sapota</i>

Table 3: Phenolic compounds isolated from family Sapotaceae

Compound	Structure(s)	Species(s)
(+)-Catechin		<i>Argania Spinosa</i> <i>Manilkara zapota</i> <i>Pouteria sapota</i> <i>Vitellaria paradoxa</i>
(+)-gallocatechin		<i>Manilkara zapota</i>
(+)-Catchin-3-O-gallate		<i>Pouteria sapota</i> <i>P. viridis</i> <i>P. campechiana</i>
Gallocatechin-3-O-gallate		<i>Pouteria sapota</i>
Leucodelphinidine		
Leucocyanidine		<i>Manilkara zapota</i>
Leucoperalgonidine		
Taxifolin-3-O-α-L-rhamnopyranoside		<i>Pouteria campechiana</i>

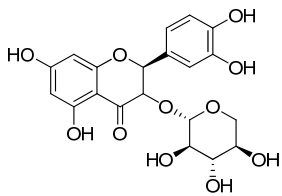
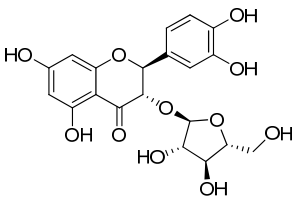
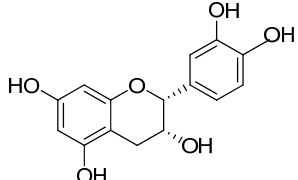
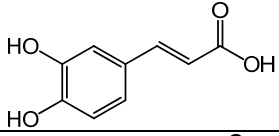
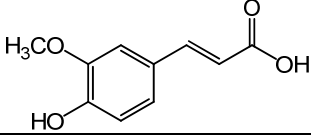
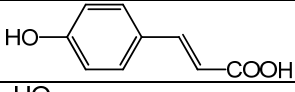
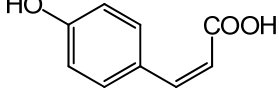
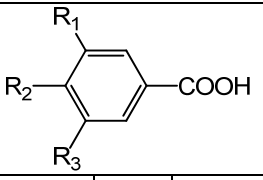
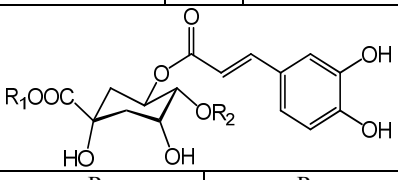
Trans-taxifolin-3-O- α -L-arabinopyranoside		<i>Pouteria campechiana</i>
Taxifolin-3-O- α -L-arabinofuranoside		<i>Pouteria campechiana</i>
(-)-Epicatechin		<i>Argania Spinosa</i> <i>Tridesmostemon omphalocarpoides</i> <i>Manilkara zapota</i> <i>Pouteria sapota</i> <i>Vitellaria paradoxa</i>

Table 4: Phenolic acids isolated from family Sapotaceae

Compound	Structure(s)			Species(s)
Caffeic acid				<i>Argania Spinosa</i> <i>Manilkara zapota</i>
Ferulic acid				<i>Argania Spinosa</i>
trans-p-Coumaric acid				<i>Synsepalum dulcificum Daniell</i>
cis-p-Coumaric acid				
				
	R1	R2	R3	
p-hydroxybenzoic acid	H	OH	H	<i>Argania Spinosa</i> <i>Synsepalum dulcificum Daniell</i>
Syringic acid	OMe	OH	OMe	
Vanillic acid	H	OH	OMe	
Veratric acid	H	OMe	OMe	
Gallic acid	OH	OH	OH	<i>Argania Spinosa</i> <i>Manilkara zapota</i> <i>Pouteria obovata</i> <i>Pouteria sapota</i>
				
	R1	R2		
Methylchlorogenate	CH ₃	H		<i>Manilkara zapota</i>
Methyl 4-O-galloylchlorogenate	CH ₃	Gallic acid		
4-O-galloylchlorogenic acid	H	Gallic acid		

Biological activities

Anticancer and cytotoxic activity

The root bark of *Butyrospermum Parkii* showed cytotoxic activity against human breast adenocarcinoma (MDA-MB-231), malignant melanoma (A375), colon carcinoma (HCT116) and glioblastoma multiforme (T98G) cell lines [25].

Sideroxylon foetidissimum root extract showed greater cytotoxic activity towards the murine macrophage-like cell line RAW 264.7 cells [26].

The ethyl acetate extract of *Argania spinosa* fruits showed cytotoxic activity against human breast cancer cells (MCF7) [27].

Stem bark of *Manilkara zapota* showed potent cytotoxic activity against HL-60 and HT-29 cell lines [28].

Stem bark of *Manilkara zapota* showed antitumor activity against Ehrlich ascites carcinoma (EAC) in Swiss albino mice [29].

The MeOH extract defatted shea (*Vitellaria paradoxa*) showed anticancer activity [30].

Bark extract of *Chrysophyllum pruniforme* showed cytotoxic effect [31]. *Manilkara zapota* fruit extract showed antitumor activity [32].

Antioxidant activity

Butyrospermum parkii showed antioxidant activity against that of Trolox or butylated hydroxytoluene (BHT) against 2, 2-diphenyl-1-picryl hydrazyl (DPPH), oxygen and nitric oxide free radicals [25].

The alcoholic extract of *Mimusops elengi* leaves showed good antioxidant activity by peroxy nitrite, superoxide and hydrochlorous acid scavenging activity [33].

The radical scavenging capacity of the methanolic extract of leaves in DPPH which showed that antioxidant capacity [34].

The MeOH extract of defatted *Vitellaria paradoxa* showed antioxidant activity [30].

The antioxidant capacity of the *Manilkara zapota* L. leaves extracts, obtained by sequential extraction with different polarities of solvents, was evaluated by four different *in vitro* methods: DPPH, superoxide and hydroxyl radical scavenging activity and reducing capacity assessment assay. The acetone extract showed best antioxidant activity [35].

Seeds extract of *Manilkara zapota* showed high antioxidant activity [36]. *Argania spinosa* showed antioxidant properties via protection against free radical-induced erythrocyte haemolysis and its ability to potentiate the antioxidant effect of Vitamin E [37].

Fruit extract of *Argania spinosa* showed potent antioxidant activity [27]. *Pouteria sapota* fruit extract showed antioxidant activity [14, 38].

The extract of three parts; leaves, fruits and stem of *Pouteria campechiana* reported as antioxidant [13, 22, 39].

The antioxidant activity of phenolic compounds isolated from *Manilkara zapota* fruits was studied [8].

Leaves extract of *Manilkara hexandra* showed antioxidant activity [40].

Anti-inflammatory Activity

Mimusops elengi leaves extract showed anti-inflammatory activity [33]. *Manilkara bidentata* ethanolic extract showed to decrease IL-1 β and IL-8 pro-inflammatory cytokines so the extract could be used as anti-inflammatory and anti-aging [41].

In evaluation of anti-inflammatory activity the crude ethanolic and ethyl acetate extract of *Manilkara zapota* leaves showed significant inhibition of paw edema in albino wistar rats so

exhibit significant anti-inflammatory activity [42].

Aqueous extract of *Elaeoluma nuda* was showed significant anti-inflammatory effect in rat adjuvant-induced arthritis [43].

The methanolic extract of defatted shea (*Vitellaria paradoxa*) showed anti-inflammatory activity [30].

Stem bark of *Vitellaria paradoxa* showed anti-inflammatory activity [18]. Acetone fraction of *Manilkara hexandra* seeds extract showed potent anti-inflammatory activity [44].

Antiulcer activity

The effect of bark alcoholic and petroleum ether extracts of *Mimusops elengi* was evaluated in rats. The alcoholic extract has significant antiulcer activity compare to petroleum ether extracts of bark [45].

The alcoholic extract of bark *Mimusops elengi* and its different fractions namely ethyl acetate, N-butanol, and methanol and aqueous against different ulcer models, and concluded that Ethyl acetate fraction possesses anti-ulcer activity against experimental gastric ulcers [46].

Stem bark of *Manilkara hexandra* (Roxb.) showed anti ulcer activity against ethanol-indomethacin and pylorus ligated gastric ulcer in experimental animals [47].

The antiulcer potential of aqueous extract of *Madhuca indica* was tested against naproxen induced gastric ulcer, omeprazole was used as a positive standard. Aqueous extract of plant of *M. indica* showed significant reduction in ulcerated area and ulcer index as compared to control group [48].

Antimicrobial Activity

Achras sapota showed antibacterial activity against Gram positive and Gram negative bacteria [49].

The methanolic extract and fractions from the stem bark of *Tridestemon omphalocarpoides* showed significant anticandidal and antibacterial against two candida species and seven aerobic bacteria [50].

Four extracts of the root of *Pachystela brevipes* showed antibacterial and antifungal against tested microorganisms [51].

Different extracts of parts of *Mimusops elengi* were tested for anti microbial activity and showed antimicrobial activity [52-55].

The extract of stem bark of *Donella ubaguiensis* showed anti microbial activity against 10 tested microorganisms [56].

The methanolic extract of *Manilkara hexandra* leaves showed invitro antimicrobial activity against different types of microorganisms [57]. Antimicrobial activities of extracts of leaves, stem bark and fruits of *Butyrospermum paradoxum* [58].

Fruit extracts of *Mimusops elengi* and *Manilkara hexandra* showed antimicrobial activities [59].

Manilkara hexandra leaf extract showed antimicrobial activity reported [60].

Antidiabetic activity

Mimusops elengi bark was reported as antidiabetic [61, 62].

The anti diabetic activity of leaves extract of *Manilkara zapota* was studied [7].

Manilkara zapota seeds and leaves showed marked anti diabetic activity [63, 64]. Both extract of *Manilkara hexandra* Leaves and Bark showed hypoglycemic effect [60, 65].

Antihyperlipidemic and hypocholesterolemic effect

Argan oil obtained from the seeds of *Argania spinosa* L. showed beneficial effect in the treatment of the hyperlipidemia and hypercholesterolemia [66]. The ethanolic extract of *Mimusops elengi* L. showed significant antihyperlipidemic effect owing to its ability to reduce the levels of total

cholesterol, triglyceride and increasing the level of HDL [67]. The reported antihyperlipidemic effect of leaves of *Manilkara zapota* are described [7, 68].

Hepatoprotective effect

The ethanolic extract of *Madhuca longifolia* bark possesses hepatoprotective activity against D-galactosamine (d-GalN) induced hepatotoxicity in rats [69]. Leaf and bark extracts of *Manilkara zapota* showed hepatoprotective effect [70].

Immunomodulatory activity

The methanolic stem bark extract of *Pouteria cambodiana* extract was showed to have immunomodulatory activity [71].

The polysaccharides from *Manilkara hexandra* bark significantly stimulating the immune system function. This activity may be due to the stimulation of macrophage function which is a known action of botanical polysaccharides [72].

The ethanolic extract of *Madhuca longifolia* showing significant immunostimulatory activity [73].

Other biological activities

Manilkara zapota leaves showed analgesic and antipyretic activities [74, 75], gastroprotective effect [76], Antifungal activity [77, 78] and aqueous extract showed Acaricidal activity [79].

Ethyl acetate extract of *Argania spinosa* showed antimalarial activity [27]. Skin-whitening and chemopreventive [30].

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