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Review Article

Phytochemicals and antimicrobial potentials of mahogany family

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ABSTRACT

Drug resistance to human infectious diseases caused by pathogens lead to premature deaths through out the world. Plants are sources for wide variety of drugs used for treating various diseases. Systematic screening of medicinal plants for the search of new antimicrobial drug candidates that can inhibit the growth of pathogens or kill with no toxicity to host is being continued by many laboratories. Here we review the phytochemical investigations and biological activities of Meliaceae. The mahogany (Meliaceae) is family of timber trees with rich source for limonoids. So far, amongst the different members of Meliaceae, *Azadirachta indica* and *Melia dubia* have been identified as the potential plant systems possessing a vast array of biologically active compounds which are chemically diverse and structurally complex. Despite biological activities on different taxa of Meliaceae have been carried out, the information of antibacterial and antifungal activity is a meager with exception to *Azadirachta indica*. Together we provide new insights of Meliaceae members demonstrating as a potential source as antimicrobial agents using *in vitro* studies.

Introduction

World wide, infectious disease is the number one cause of death accounting for approximately one-half of all deaths in tropical countries. Plants constitute one of the major raw materials of drugs for treating various human diseases. The modern society has been interested in drugs of natural origin due to their harmonious nature with our biological system (Amalraj, 1983). It is reported that 41% prescriptions in USA and 50% in Europe contain constituents from natural products which shows that the trend of using natural products is getting increased. Scientific research on medicinal plants relies on identification of the active principles in the plants; scientific examination of the remedies which lead to standardization and quality control of products to ensure their safety. It is after such evaluations that they can be approved for use in the primary health care. Such research activities could also lead to the development of new drugs as in the past (Farnsworth et al., 1985; Farnsworth, 1988). Phytochemical tests have been performed in about 5000 species and nearly 1100 species are extensively exploited in Ayurvedic, Unani and Allopathic medicines. In fact active plant extracts screening programs continue to end always with new drug discoveries.

In order to find new sources of plant drugs, number of plants has been screened for wide range of biological activity in various research institutions. Plant based antimicrobials represent a vast untapped source for medicines by possessing enormous therapeutic potential. They are effective in the treatment of infectious diseases while simultaneously mitigating many of the side effects that are often associated with synthetic antimicrobials. Although, a number of antibiotics are widely used in medicine, the search for antimicrobial substances from plants will continue as better and safer drugs to combat bacterial and fungal infections are still needed, because of their biodegradable nature and being relatively safer for human beings and non-target organisms in the environment. Extensive survey of the flora has been undertaken to search for potential plant extracts, which could

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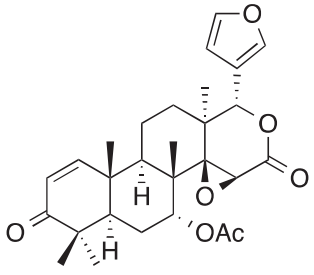
be used in the management of agriculture and household pests. In order to study possible applications of extracts or compounds derived from extracts, methods to screen for biological activities and separation techniques to isolate the active principles have to be established. Nearly 80% of the world's population relies on traditional medicines for primary health care, most of which involve the use of plant extracts (Sandhya et al., 2006). Almost 95% of the prescriptions are plant based in the traditional systems of Unani, Ayurveda, Homoeopathy and Siddha (Satyavati et al., 1987).

The mahogany (Meliaceae) family comprises more than fifty genera with about 1400 species (Nakatani et al., 2001) is distributed in tropical and subtropical regions. The family is represented by seventeen genera and 72 species of which twelve species and two varieties endemic in India. Approximately 18% are endemic to peninsular India. From 19th century up to the present time, the mahoganies have been the most important species for the development of the forest industry in Asia, tropical Africa and Latin America. Many species of this family were used in traditional medicine for treatment of various diseases and also in pest control. Here we review the phytochemical investigations and biological activities of Meliaceae. Together we provide insights of Meliaceae members demonstrating as a potential source as antimicrobial agents using *in vitro* studies. Till to date there is no review published on the phytochemical constituents and their antimicrobial properties of Meliaceae. Hence our review aims to coherently unite results obtained from various published investigations on this important family. Here we address the important phytochemical constituents of Meliaceae and plants that have been investigated for their antimicrobial potential other than *A. indica* from Meliaceae.

Phytochemical studies of Meliaceae

Various classes of chemical constituents were isolated from different parts of meliaceous members. Chemically, the Meliaceae is characterized by synthesis of modified triterpenes known as limonoids. Over 300 limonoids have been isolated to date and they are more diverse and abundant in this particular family than in any other family. Several triterpenoidal derivatives were also isolated from different genera of Meliaceae. Amongst different members of Meliaceae, *Azadirachta indica* had been extensively studied for its chemicals. Limonoids are secondary metabolites produced in plants found in the order Rutales. Over 300 limonoids have been isolated to date (Taylor, 1986; Champagne et al., 1992) and their production is confined to plants in the order Rutales. In particular, they are characteristic members of the family Meliaceae where they are diverse and abundant (Taylor, 1981; Connolly, 1983) than in any other family and less frequently in the families Rutaceae and Cneoraceae.

Limonoids are described as modified triterpenes, having a 4,4,8-trimethyl-17-furanyl steroid skeleton. The term limonoids was derived from limonin, the first tetranortriterpenoid obtained from citrus bitter principles (Roy and Saraf, 2006). The effect of ring structure and chemical oxidation state parameters is a focus of why limonoids exhibit activity against insect herbivores. Arrangements of subgroups and ring structures within this basic building block provide a host of characteristics that have generated interest in this plant product. These characteristics include insecticidal, insect growth regulation, insect antifeedant, and medicinal effects to animals and humans such as antibacterial, viral, and antifungal properties. Of recent great interest, limonoid's possible anticarcinogenic properties are being explored. Of special interest to countries in tropical locations is the antimalarial activity attributed to tropical Meliaceae extracts and gendunin **(1)** derivatives. Previous investigations from various plant parts of Meliaceae led to the isolation of tetranortriterpenoids with a modified furan ring such as febrifugin **(2)** (Rao et al., 1978) methyl angolensate **(3)**, luteolin-7-*O*-glucoside **(4)**, deoxyandirobin **(5)** from the bark (Ambaye et al., 1971; Adesida and Taylor, 1972; Purushothaman and Chandrasekharan, 1974; Purushothaman et al., 1977).



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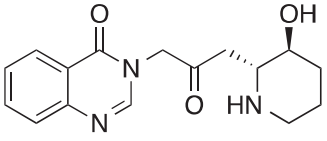

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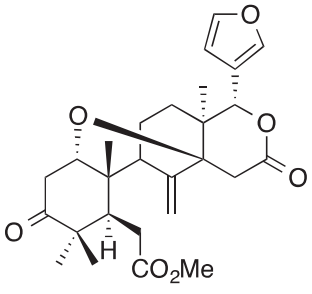

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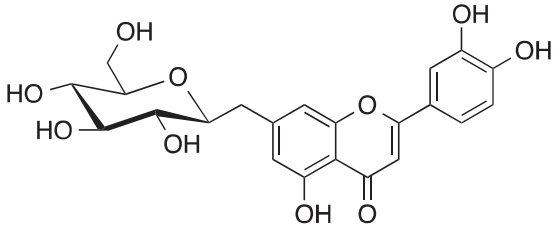

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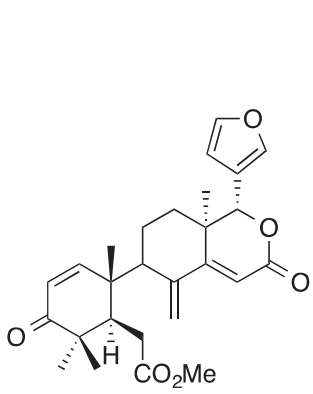
Tetranortriterpenoids febrifugin **(2)** (Rao et al., 1978) and febrinins A and B **(6)** (Rao et al., 1979) together with the flavonoids naringenin **(7)**, quercetin **(8)**, myricetin **(9)** and dihydromyricetin **(10)** from the heartwood (Rao et al., 1979).



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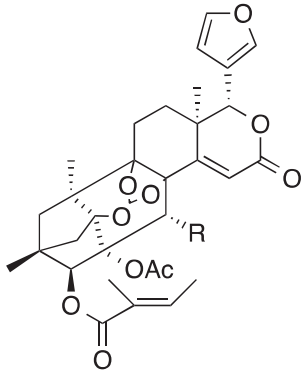

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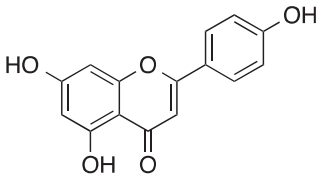
R=COC_2H_5 - febrinin A
R=$COCH_2$ - febrinin B



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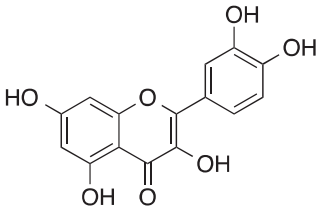

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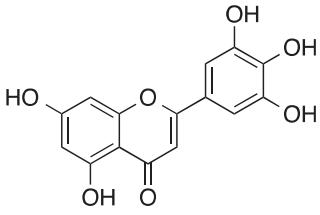

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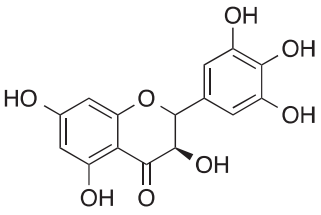

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Seed oil containing linolenic, linoleic, oleic, palmitic and stearic acid, lupeol and sitosterol (Yoganarasimhan, 1996). Leaves were found to contain quercetin-3-*O*-L-rhamnoside and 3-*O*-rutinoside (Rastogi and Mehrotra, 1993).

In view of the characteristic occurrence of the gedunin nucleus in the Meliaceae, the name meliacin has been proposed for this nucleus (Bevan et al., 1963). Compounds which may arise from closely similar biogenetic routes have also been isolated from the related families Rutaceae and Simarubaceae (Arigoni et al., 1960; Narayanan et al., 1964). It has been proposed that the Meliaceae compounds are derived biogenetically from an apo-euphol type triterpene in which the side chain has been oxidized leaving a furan ring (Arigoni et al., 1960). Possessing a reduced furan ring, flindissol is structurally midway between epo-euphol and the meliacins, and indicates a biochemical relationship between the two families. This interference is strengthened by the occurrence of a coumarin, a characteristic of the Rutaceae, in *Ekbergia senegalensis* (Meliaceae). It is hoped that elucidation of the structures of the other meliacins will reveal features giving more information about the biochemical relationships of these compounds, as well as making available further taxonomic criteria in this important family.

Various classes of chemical constituents were isolated from different parts of meliaceous members (Box 1). Amongst the different members of Meliaceae, *Azadirachta indica* and *Melia dubia* have been identified as the potential plant systems possessing a vast array of biologically active compounds, which are chemically diverse and structurally complex. It seems that other members of this family are tested for secondary metabolites and bioactivity besides multiplication, overcoming physiological barriers.

Antimicrobial activity of Meliaceae

One of the major triumphs of medical science in the millennium has been the virtual eradication of many infectious diseases by the use of specific antimicrobial agents. Two important discoveries marked the beginning of a new era in chemotherapy. First discovery in 1935 curative discovery and development of the sulfonamide on *Streptococcal* infection. Second important pharmacokinetic property of the antibiotics quite varied, as are their antimicrobial spectra and mechanisms of action. Although, a number of antibiotics are widely used in medicine, the search for antimicrobial substances from plants will continue as better and safer drugs to combat bacterial and fungal infections are still needed, because of their biodegradable nature and being relatively safer for human beings and non target organisms in the environment. Plant extracts that inhibit pathogenic microorganisms without harming the host may have potential use as therapeutic agents. The susceptibility of a microorganism to antibiotics and other chemotherapeutic agents can be determined by the different methods available like tube-dilution, Paper-disk-plate, cylinder and well methods, single disk method and agar overlay method. The screening of large numbers of bacteria and fungi with various antibiotics and synthesized drugs requires simple techniques that can be used with several samples at the same time. Disk diffusion method for susceptibility testing currently recommended by the FDA is a slight modification of the procedure developed by Bauer et al. (1966). Different parts of meliaceous members were screened for the antibacterial and antifungal activity (Box 2).

Ethyl acetate extracts of *Chukrasia tabularis* leaves inhibited the growth of microorganisms like *Staphylococcus aureus*, *Escherichia coli*, *Proteus vulgaris*, *Klebsiella pneumoneae*, *Aspergillus fumigatus* and *Pseudomonas aeruginosa* (Nagalakshmi et al., 2001). Jayasinghe et al. (2002) screened the antimicrobial activity of two Meliaceae members like *Agalia congylos* and *Munronia pumila*. According to them the methanol, n-hexane and dichloromethane extracts of leaves, bark and stem displayed the wide spectrum of antimicrobial activity against *Aspergillus*, *Saccharomyces*, *Ustilago*, *Eschericia*, *Micrococcus* and *Bacillus* species. Antibacterial activity of methanol and acetone flower extracts of Azadirachta indica by disk assay on most sensitive organisms like *Staphylococcus aureus*, *Listeria monocysgenes*, *Escherichia coli*, *Bacillus cereus* and *Salmonella infantis* were tested by Alzoreky and Nakahara (2003). Aladesanmi and Odediran (2000) stated that Trichlia heudelotti leaves can be regarded as having moderate antibacterial and antifungal activities determined by the cup plate method using n-hexane, ethyl acetate, methanol extracts and some isolated compounds. Chowdhury et al. (2003a) reported that petrol ether, dichloromethanol and methanol extracts along with siderin of two Meliaceae medicinal plants, *Toona ciliata* and *Amoora rohituka* (stem bark) exhibited significant antibacterial activity and mild antifungal effect.

Although several aspects of biological activity on different taxa of Meliaceae have been carried out, the information of antibacterial and antifungal activity is a meager excepting that of *Azadirachta indica*. Samy and Ignacimuthu (1998) reported that when antibacterial activity of different crude extracts of seed kernel, seed coat and leaves of *Azadirachta indica* were tested against *Escherichia coli*, *Pseudomonas aerogenes*, *Klebsiella aerogenes* and *Proteus vulgaris*, only the seed kernel extracts was found to show significant

Box 1: Phytochemical investigations of Meliaceae.

Plant	Part used	Compound	Reference
Aglaia andamanica	Leaves	Limonoid 24-*epi*-mellanodiol, the tirucallane aglaidiol and the two cyclopenta tetra hydrobenzo pyran derivatives pyramidaglan A and B	Puripattanavong et al., 2000
Aglaia argentea	Leaves	Cycloartanes, argenteanones C-E and genteanols B-E	Mohammad et al., 1997
		Cycloartanes: argenteanones A and B, and argenteanol	Omobuwajo et al., 1996
	Bark	3,4-Seco apo tirucallanes, argentinic acids A-I	Mohamad et al., 1999a
	Seeds	Apotirucallane triterpenes-gentinones A-D and gentinin	Omobuwajo et al., 1996
Aglaia cordata	Stem bark	Aglacins I-K three highly methoxylated lignans	Wang et al., 2004a
Aglaia crassinervia	Bark	Glabretal-type triterpenoids, aglaiaglabretols A-C, nine known compounds, 3-*epi*-cabraleahydroxylactone, cabraleahydroxylactone, rocaglaol, 2β,3β-dihydroxy-5α-pregn-17(20)-(E)-16-one, scopoletin, mixtures of cabraleadiol, epicotillol, β-sitosterol and stigmasterol	Su et al., 2006
Aglaia dasyclada	Leaves	Rocaglamides, glycosides and putrescine bisamides	Chaidir et al., 2001
Aglaia duperreana	Twigs and leaves	Rocaglamide derivatives and rocaglamides	Nugroho et al., 1997a
	Flowers	Insecticidal cyclopenta tetra hydro benzofuran derivatives of rocaglamide	Chaidir et al., 1999
Aglaia edulis	Leaves	A bisamide, aglaiduline, and sulfur-containing bisamides, aglaithioduline and aglaidithioduline	Saifah et al., 1999
	Bark	Benzo[*b*]oxepine derivatives, edulisones A and B	Kim et al., 2005
		Cyclopenta[*b*]benzofurans, aglaroxin A 1-*O*-acetate and 3′-methoxyaglaroxin A 1-*O*-acetate, benzo[*b*]oxepine, 19,20-dehydroedulisone A, and cyclopenta[*bc*]benzopyrans, edulirin A, edulirin A 10-*O*-acetate, 19,20-dehydroedulirin A, isoedulirin A, and isoedulirin B, cyclopenta[*b*]benzofuran, aglaroxin A	Kim et al., 2006
	Roots	Favaglines, cyclopenta[*bc*]benzopyrans (thapsakins) and benzo[*b*]oxepines (thapoxepines), together with two known cyclopenta[*b*]benzofurans, aglaroxin A and pannellin	Bacher et al., 1999
Aglaia elaeagnoidea	Bark	Lignans *trans*-2,3-bis(3,4,5-trimethoxybenzyl)-1,4-butanediol diacetate and 20S,24S-epoxy-25-hydroxymethyldammarane-3-one, one 1H-cyclopentatetrahydro[*b*]benzofuran, two dammarane triterpenoids and one limonoid	Fuzzati et al., 1996
Aglaia elliptica	Fruits	Rocaglamide derivatives along with rocaglamide and didesmethylrocaglamide	Nugroho et al., 1997b
Aglaia exima	Leaves	Cycloartane; 24(E)-cycloart-24-ene-26-ol-3-one, cycloartane-type triterpenoids 24(E)-cycloart-24-ene-26-ol-3-one, cycloart-24-ene-3β,26-diol, schizandronic acid, 24(E)-3β-hydroxycycloart-24-ene-26-al, vaticinone, one dammarane-type triterpenoids cabraleahydroxylactone, and two steroids; β-sitosterol and stigmast-5-ene-28-one	Awang et al., 2012
	Stem bark	Stigmastane steroid, 3,4-epoxy-(22R,25)-tetrahydrofuran-stigmast-5-en, triterpenoids dammara-20,25-diene-3b,24-diol, dammara-20S, 5a,24-en,3b,20-diol and steroids stigmasterol 3-*O*-β-d-glucoside and stigmast-5-ene-3b,4b-diol	Harneti et al., 2014
Aglaia foveolata	Leaves	Flavagline derivatives: foveoglin A, foveoglin B, isofoveoglin, cyclofoveoglin, secofoveoglin and silvestrol, pyramidatine	Salim et al., 2007a
	Stem bark	Baccharane-type triterpenoid and silvestrol,17,24-epoxy-25-hydroxy-3-oxobaccharan-21-oic acid	
		Dammarane triterpenes, foveolins A and B, together with three known, 3-epi-ocotillol, eichlerianic acid and shoreic acid	Roux et al., 1998
Aglaia gracilis	Leaf	Secopiriferine and secoodorine and known compounds flavonol, flavagline, odorine, piriferine, pyramidatine, norsesquiterpene, desacetylaglain A, aglaistatin,	Grege et al., 2001
	Root bark	Marikarin and 3′-hydroxy-marikarin along with known algafoline, aglaiastatin, dehydroalgastatin, shoreic acid	Grege et al., 2001
Aglaia grandis	Leaves	Pregnanes and cycloartane type triterpenoid hydroperoxides	Inada et al., 1997
		Putrescine bisamides grandiamides A-C and aromadendrane-type sesquiterpene 4b,10a-dihydroxyaroma-Dendrane	Inada et al., 2000
Aglaia harmsiana	Leaves	Cycloartane type triterpene-Cycloartane-3β,29-diol-24-one, (24R)-cycloartane-24,25-diol-3-one	Inada et al., 1995
		Rocaglamide compound	Nugroho et al., 1997b
Aglaia ignea	Bark	Dammarenolic acid	Esimone et al., 2010
Aglaia lawii	Leaves	Dammaranes, aglinins A and B together with cabraleone, eichlerianic acid and shoreic acid	Mohamad et al., 1999a
	Bark	A pregnane steroid, namely (E)-aglawone 20S, 24S-epoxy-dammarane-3α,25-diol acetate	Qiu et al., 2001
Aglaia leucophylla	Stem bark	(+)-ocillatone, (+)-ocotillol, (+)-cabraleone, (+)-eichlerianic acid, (+)-caryophyllene oxide, (24Z)-3,4-secotirucalla-4 (28) 7,24-triene-3,26-dioic acid and 3-monomethyl ester.	Benosman et al., 1994
		Tirucallane triterpene, (−)-leucophyllonealong with (−)-caryophyllene oxide, (−)-niloticin, (−)-bourjotinolone and (−)-piscidinol.	Benosman et al., 1995

Box 1 (*Continued*)

Plant	Part used	Compound	Reference
Aglaia loheri	Leaves	Spinasterol, trilinolein, phytyl fatty acid ester	Ragasa et al., 2012
Aglaia odorata	Leaves	Cyclopenta tetra hydro benzo furans along with desmethyl rocaglamide, methyl rocaglate, rocaglaol	Ishibashi et al., 1993
		Odorine, odorinol and dehydrodorin	Duh et al., 1993
		Rocaglamide congeners, aglain derivatives, two aminopyrrolidines odorine and odorinol, three flavonoid derivatives and syringaresinol	Nugroho et al., 1999
		Dolabellane diterpenoids (1R,3E,7E,10S,11S,12R)-dolabella-3,7-dien-10,18-diol, (1R,3S,7E,11S,12R)-dolabella-4(16),7-dien-3,18-diol, (1R,7E,11S,12R)-18-hydroxydolabella-4(16),7-dien-3-one, (1R,3S,4S,7E,11S,12R)-3,4epoxydolabella-7-en-18-ol, and (1R,3R,7E,11S,12R)-dolabella-4(16),7,18-trien-3-ol.	Cai et al., 2010
		Dolabellane diterpenoids, two dammarane triterpenoids and a protostane triterpenoid	Yodsaoue et al., 2012
	Leaves twigs	Coumarinolignoid, 8-(70,80,90-propanetriol-40-methoxy-30-*O*-phenylpropanoid)-7-hydroxy-6-methoxycoumarin.	Zhang et al., 2012a
	Twigs	Insecticidal rocaglamide compounds	Nugroho et al., 1999
		Norsesquiterpene 4α, 10β-dihydroxy-1βH,5αH-guai-6(7)-en-11-one and four new sesquiterpenes 1β,4α,7β-trihydroxy-14β-methyl-eudesman-11(12)-ene, 1α,6β,12-trihydroxy-1βH,5αH,11H-guai-6(7)-ene, 4α7β,11-trihydroxy-1βH,5αH-guai-10(14)-ene, and 4α,10α,11-trihydroxy-1βH,5βH-guai-7(8)-ene along with four known guaianediol, orientalol A, orientalol B and 1β,6α-dihydroxy-10β-methyl-5αH,7αH-eudesm-4-one	Liu et al., 2014
	Dried twigs	Dammarane triterpenes and aminopyrolidine bis-amides such as odorinol	Janprasert et al., 1993
	Flower essential oil	Cadinane derivatives murrola-4,10 (14)-dien-1β-ol accompanied by 1α-alchol, methyl jasmonate	Weyerstahl et al., 1999
Aglaia oligophylla	Leaves	Dipterocarpol, ocotillone, cabraleone, ocotillol, 20(S),24(S)-dihydroxydammar-25-en-3-one, 20S,25-epoxy-24R-hydroxy-3-dammaranone, 20S,25-epoxy-24R-hydroxydammarane-3a-ol, flavagaline rocaglaol, bisamides odorine and 20-*epi*-odorine	Joycharat et al., 2008
Aglaia ponapensis	Leaves and stems	Cyclopenta[*bc*]benzopyran, ponapensin, and an aglaialactone, 5,6-desmethylenedioxy-5-methoxy-aglalactone, cyclopenta[*b*]benzofuran(methyl rocaglate) four cyclopenta[*bc*]benzopyrans 4-*epi*-aglain A, aglain B, 10-*O*-acetylaglain B, and aglain C, and four pregnane steroids (E)-volkendousin, (Z)-volkendousin, 2β,3β-dihydroxy-5-pregn-17(20)-(E)-en-16-one, 20 and 2β,3β-dihydroxy-5-pregn-17(20)-(Z)-en-16-one	Salim et al., 2007b
Aglaia rubiginosa	Leaves	Androstane derivatives. 17-octanor-cycloartane-ring-A-seco acid Four cyclo artane-type triterpenes and three unusual cholesterol derivatives	Weber et al., 2000
	Twigs	Cyclopenta{b}benzofuran, 1-*O*-acetyl rocaglaol	Rivero-Cruz et al., 2004
Aglaia silvestris	Leaves, twigs and roots	Triterpenoids silvaglin A, B, methylisofoveolate B, methylfoveolate B, isosilvaglin A, B, desoxysilvaglin B, aglasilvinic acid, isoeichlerianic acid, methylfoveolate B, aglasilvinic acid, one pregnane steroid pregnacetal, two sesquiterpenes viridiflorol, α-muurolene	Pointinger et al., 2008
	Roots	Silvaglenamin-unusual dimeric triterpene structure with two dammarane units linked with an enaminic —NH— group	Hofer et al., 2009
Aglaia smithii	Bark	Dammarane triterpenoids, aglinone and aglinin E (20S,24S-epoxy-25-hydroxy-1-endammarene) along with three known compounds, 3-epiocotillol, aglinin A and eichlerianic acid	Harneti et al., 2012
Aglaia spectabilis	Bark	Rocaglamide derivatives	Schneider et al., 2000
	Leaves	Two bisamides secoisopiriferinol and secoisoodorinol	Greger et al., 2008
Aglaia tenuicaulis	Leaves, stem and root bark	Six amide-esters tenucaulin A, B, isotenucaulin A, aglatenin, tenaglin, caulitenin and two sulphur-containing bisamides pyrrolotenin, secopyrrolotenin	Greger et al., 2008
Aglaia testicularis	Leaves	Rocaglamide derivatives 1 and 2, one aglain derivative aglaxiflorin D, two cinnamic acid-derived bisamides, piriferine and odorinol and a diarylbutane lignan, secoisolariciresinol dimethyl ether	Wang et al., 2004b
Aglaia tomentosa	Bark	Dammaranes, aglinins C and D two pregnane steroids, aglatomins A and B and cyclopentate-trahydrobenzofuran, rocaglaol	Mohamad et al., 1999b
Amoora rohituka	Bark	Amoorinin	Agnihotri et al., 1987
	Stem bark	Guaiane-derived sesquiterpenoids,6β,7β-epoxyguai-4-en-3-one and 6β,7β-epoxy-4β,5-dihydroxyguaiane.	Chowdhury et al., 2003b
	Seeds	7-Keto-octadec-cis-11-enoic acid	Daulatabad and Jamkhandi, 1997
Aphanamixis grandifolia	Leaves and twigs	Tirucallane triterpenoids, 2α-ethoxy-2,3-secotirucalla-2,29-epoxy-7-ene-23-oxo-3-oic acid (1) and (23E)-2α-hydroxytirucalla-7,23,25-triene-3-one and a tirucallane triterpenoid 2,3-secotirucalla-2,3; 2,29-diepoxy-7-ene-3,23-dione	Wang et al., 2012a
		Cycloartane triterpenoids, aphagrandinoids A-C and aphagrandinoid D, and (20R)-3β-hydroxy-24,25,26,27-tetranor-5α-cycloartan-23,21-olide	Wang et al., 2013

Box 1 (*Continued*)

Plant	Part used	Compound	Reference
	Leaves and stem	Terpenoids, nemoralisins D-G, diterpenoids, nemoralisin C and nemoralisin	Zhang et al., 2014
	Stem barks	Tirucallane type C_{26} triterpenoids, 3a-hydroxyl-21a-methoxy-24,25,26,27-tetranortirucall-7-ene-23(21)-lactone, 3a-hydroxy-21b-methoxy-24,25,26,27-tetranortirucall-7-ene-23(21)-lactone, 3-oxo-21a-methoxy-24,25,26,27-tetranortirucall-7-ene-23(21)-lactone, 3-oxo-21b-methoxy-24,25,26,27-tetranortirucall-7-ene-23(21)-lactone, and 3-oxo-21a-ethoxy-24,25,26,27-tetranortirucall-7-ene-23(21)-lactone	Zhang et al., 2010
		Tirucallane C27-triterpenoid epimers, aphagranins A and B	Wang et al., 2012b
	Stem	2,3-Seco-tirucallane triterpenoid derivatives aphanamgrandins A-F, three 3,4-seco-29-nor-tirucallane triterpenoid derivatives aphanamgrandins G–I, one 3,4-seco-tirucallane triterpenoid aphanamgrandin J, two tirucallane triterpenoids aphanamgrandin K and (23Z)-25-hydroxy-tirucalla-7,23-diene-3-one and three known triterpenoids (23S)-21,23-epoxy-5a-cycloart-24-en-3b-ol, 3b,25-dihydroxy-tirucalla-7,23-diene, and (−)-leucophyllone.	Zeng et al., 2012
		Triterpenoid Aphanamgrandiol A	Zeng et al., 2013
	Fruits	Limonoids aphanamolides C and D, aphanamolide A and aphapolynin A	Zhang et al., 2013a
Aphanamixis polystachya	Stem bark	Diterpenes possessing rare five-membered peroxide ring, aphanaperoxides E-H	Wu et al., 2013
	Bark	Dihydroamoorinin	Agarwal et al., 2001
	Roots	Limonoids and flavonoids Amoorinin-3-*O*-α-l-rhamnopyranosyl-(1 to 6)-β-d-gluco pyranoside, 8-methyl-7,2′,4′-tri-*O*-methyl flavonone-5-*O*-α-l-rhamnopyranosyl-(1 to 4)-β-d-glucopyranosyl-(1 to 6)-β-d-glucopyranoside and 8-*C*-methyl-5,7,3′,4′-tetrahydroxy flavone-3-*O*-α-l-arabino pyranoside	Srivastava et al., 2003
	Fruits	Ring A-seco limonoids, aphanalides A-H	Wang et al., 2012c
		Highly oxidized A,B-seco limonoids, aphapolynins A and B	Zhang et al., 2011
	Seed	Limonoids rohituka-12, rohituka-13 and rohituka-14 and kihadalactone A and known compounds polystachin, rohituka-7 and rohituka-9.	Mulholland and Naidoo, 1999
Astrotrichilia asterotricha	Bark	Astrotrichilin	Mulholland et al., 1996
Astrotrichilia voamatata	Stem bark	Voamatins A and B	Mulholland et al., 1999a
	Stem bark	Voamatins C and D	Mulholland et al., 2000a
Azadirachta indica	Leaves	Nimbolide, 28-deoxonimbolide	Kigodi et al., 1989
		Nimbinene and 6-deacetyl nimbinene, nimbadiol, hyperoside, quercetin, rutin, meldenindiol, 4α,6α-dihydroxy-A-homoazadirone	Rastogi and Mehrotra, 1993
		Tetracyclic triterpenoids zafaral 24,25,26,27-tetranorapotirucalla-(apoeupha)-6α-acetoxy-1,14-dien-3,16-dione-21-al(1) and meliacinanhydride 24,25,26,27-tetranorapotirucalla-(apoeupha)-6α-hydroxy, 11α-methoxy-7α,12α diacetoxy,1,14,20(22)-trien-3-one (2)	Siddiqui et al., 2004
		Teetranortriterpenoids 24,25,26,27 tetranorapotirucalla-(apoeupha)-6α-*O*-methyl, 7α-*S* enecioy (7-deacetyl)-1α,12α,21,23-tetrahydroxy-21,23-epoxy-2,14,20 (22)-trien-1,16-dione (1)	Siddiqui et al., 2003
		Triterpenoids 22,23-dihydronimocinol and des furano-6-α-hydroxyazadiradione	Siddiqui et al., 2002
	Seeds	1α-Methoxy-1,2-dihydroepoxyazadiradione, 1β,2β,14β,15β-diepoxyazadiradione, 7-acetylneotrichilenone, three C-7 benzoates of tetranortriterpenoids (I, II, III), nimbin and β-sitosterol, nimbinene and 6-deacetyl nimbinene, nimbandiol	Rastogi and Mehrotra, 1993.
		Tetranortriterpenoids 1α,2α-epoxy-17β-hydroxyazadiradione,1α,2α-epoxynimolicinol, 7-deacetyl nimolicinol	Hallur et al., 2002
		Margocin, margocinin and margocilin	Ara et al., 1990
		Limocinol, limonone, limocin A and B, limocinin.	Siddiqui et al., 1991
	Root bark	7α-acetoxy-4,4,8-trimethyl-5α-(13α Me)-androsta-1,14-dien-3,16-dione,7α-acetoxy-4,4,8-trimethyl-5α-(13α Me)-17-oxa-androsta-1,14-dien-3,16-dione and 7α-acetoxy-4,4,8-trimethyl-5α-17-oxa-androsta-1,14-dien-3,16-dione	Siddiqui et al., 1992
	Fruits	Nimolicinol	Rastogi and Mehrotra, 1993
	Nodal callus	Azadirachtin	Babu and Nair, 2004
Azadirachta indica	Seed kernels	Azadirachtin derivatives, 29-oxymethylene azadirachtin analogue,29-oxymethylene-11-demethoxy-carbonyl-11-α-hydroxy azadirachtin (azadirachtin M), 22,23-dihydro-23α hydroxy-3-tigloyl-11-deoxyazadirachtin (azadirachtin N)	Luo et al., 1999
		Apo-tirucallols, 1a,7a-diacetoxyl-17a-20S-21,24-epoxy-apotirucall-14-ene-3a,23R,24S,25-tetraol	Luo et al., 2002
	Seeds	11-Hydroxyazadirachtin-B, 1-tigloyl-3-acetylazadirachtinin, 1,2-diacetyl-7-tigloyl-12-hydroxy vilasinin and 23-desmethyl limocin-B	Kumar et al., 1996
	Fruit coats	Azadironolide, iso azadironolide, azadiradionolide	Siddiqui et al., 1999
		Tetracyclic triterpenoids, salimuzzalin, azadirolic acid, azadiradionol, azadironol	Siddiqui et al., 1998
		Tetranortriterpenoid, 11-epi-azadirachtin H	Ramji et al., 1996

Box 1 (*Continued*)

Plant	Part used	Compound	Reference
	Dried cells and seed kernel	Azadirachtin	Jarvis et al., 1997
		Triterpenoid, 1α,7α-diacetoxy apo tirucall-14-ene-3α,21,22,24,25-pentaol.	Luo et al., 2000e
	Flowers	Neeflone, a new tetranortriterpenoid-15-acetoxy-7-deacetoxydihydro azadione	Nanduri and Banstola, 1995
	Essential oil of flowers	Sesquiterpenes α-cubebene, copaene, humulene, δ-cadinene, 3,4-dimethylthiophene, dipropyl disulphide, nonanal, propyl propenyl disulphide, δ-elemene, α-gurjunene, linalool, caryophyllene, aromadendrene, *allo*-aromadendrene, viridiflorene, α-muurolene, δ-cadinene, bicyclogermacrene, *cis*-3,5-diethyl-1,2-4-trithiolane, cadina-1,4-diene, *trans*-3,5-diethyl-1,2,4-trithiolane, 2-tridecanone, calamene, α-calacorene, palustrol, ledol, nerolidol, ethyl laurate, cubenol, epicubenol, globulol, viridiflorol, τ-cadinol, τ-muurolol, phytol	Aromdee and Sriubolmas, 2006
Azadirachta excelsa	Stem	4 Meliacin type limonoids, two novel namely and 2,3-dihydronimbolide and 3-deoxy methyl nimbidate	Cui et al., 1998
Cabralea canjerana	Stem	Dammarane triterpenes 20S,24S-epoxy-7b,25-dihydroxy-3,4-secodammar-4(28)-en-3-oic acid, 20S,24S-epoxy-7b,15a,25-trihydroxy-3,4-secodammar-4(28)-en-3-oic acid and 20S,24R-epoxy-7b,22x,25-trihydroxy-3,4-secodammar-4(28)-en-3-oic acid, known dammarane triterpenes ocotillone, eichlerianic acid, shoreic acid and the sterols sitosterol, campesterol, sitostenone stigmasterol, and stigmast-5-en-3-one	Campos Braga et al., 2006
	Branches	Ocotillone, eichlerianic acid, shoreic acid and eichlerialactone	Campos Braga et al., 2006
Capuronianthus mahafalensis	Stem barks	Protolimonoid, capulin	Fossen et al., 2012
Carapa guianensis	Twig	1,3-Di-benzene carbon amine-2-octadecylic acid-glyceride (new), hexacosanoic acid-2,3-dihydroxy-glyceride (first time from natural source), ursolic acid, naringenin, scopoletin, 3,4-dihydroxymethylbenzoate, 2,6-dihydroxymethylbenzoate, tetratriacontanoic acid, triacontanoic acid.	Qi et al., 2004
	Flower oil	Mexicanolides and phragmalin-type limonoids named Andirolides A, B, C, D, E, F and G, with the known 7-deacetoxy-7-oxogedunin and 6a-acetoxygedunin	Tanaka et al., 2011
	Flower oil	Gedunins andirobin, three mexicanolides, and two phragmalin-type limonoids andirolides H, I, J, K, L, M, N, O, and P	Tanaka et al., 2012
	Flower oil	Gedunins, an andirobin, two mexicanolides, and a phragmalin-type limonoid, named andirolides Q, R, S, T, U and V	Sakamoto et al., 2013
	Seeds	Limonoids, carapanolides A and B	Inoue et al., 2012
Cedrela odorata	Leaves	Tetranor tri tetraterrpenoids, 3-deoxo-3β, 8β epoxy-6,14α, dihydroxy-8,14α-dihydromxi canolide, cedrodorin: 3-deoxo-3β, 8β epoxy-6-14α hydroxy-8,14-dihydro mexicanolide, 6-acetoxy cedrodorin: 3-deoxo-3β, 8β epoxy-6-14α hydroxy-8, 14-dihydromexicanolide, 6-deoxy-9α-hydroxy cedrodorin and 3-deoxo-3β,8β-epoxy-6,9α, 14α-di hydroxy-mexicanolide (9α-hydroxy cedrodorin)	Veitch et al., 1999
	Leaf essential oil	Sesquiterpenoids: α-santalene, β-acoradiene, β-elemene caryophylleneoxide, Z-α-bergamotene	Asekun and Ekundayo, 1999
	Stems	Sesuiterpenes, triterpenes, limonoids and flavonoids	De Paula et al., 1997
	Stem bark	Nomilin/obacunol derivatives 11β-acetoxyobacunyl acetate, 11β,19-diacetoxy-l-deacetyi-l-epidihydronomilin, 11β-acetoxyobacunol and odoralide and swietenolide derivative 8β,14α-dihydroswietenolide, and seven known limonoids of two nomilin derivatives, 7-acetyldihydronomilin, and 7-acetyl-11b-acetoxydihydronomilin, five mexicanolides, swietenolide, 3b,6-dihydroxydihydrocarapin, xyloccensin K, 3b-hydroxydihydrocarapin and cedrodorin	Kipassa et al., 2008
	Bark oil	Sesquiterpene hydrocarbons and oxygenated sesquiterpenes 43.9%, 42.4% respectively. α-copaene (14.4%), α-cadinol (11.2%), β-eudesmol (9.4%), delta-cadinene (9.2%).	Martin et al., 2003
	Heart wood	3-oxo-threo-23,24,25-tri hydroxy tirucall-7-ene and 3β-*O*-δ-glucopyranosyl-24-methylene cholesterol	Campos et al., 1991
Cedrela mexicana	Leaves and stem bark oil	Sesquiterpenes α-terpinyl actate spathulenol, elemol, alismol	Ogunwande et al., 2005
Cedrela salvadorensis	Leaves	Flavonol rhamnosides-(−)-epicatechin, a fzelin and quercitrin	Barrios-Chica and Castro-Castillo, 1995
Cedrela sinensis	Leaves	Cedrellin and 2,6,10,15-phytatetraene-14-01-	Luo et al., 2000a
		Five limonoids:11β-hydroxy-7α-obacunyl acetate,11-oxo-7α-obacunyl acetate, 11-oxo-7α-obacunol, 11β-hydroxyceneorin G,11-oxocneorin G	Mitsui et al., 2004
	Seeds, leaves, and stems	Apotirucallane triterpenoids	Mitsui et al., 2005
	Rachis	Methyl gallate, quercitrin, bis-(*p*-hydroxy pheny)-ether adenosine, isoquercitrin, rutin, (+)-catechin and (−)-epicatechin	Park et al., 1996
Cedrela tonduzii	Leaves	Quercetin-3-glucoside 2 and robinine	Rastogi and Mehrotra, 1993
Cedrela tubiflora	Leaves	Water-soluble polysaccharide	Benencia et al., 1999

Box 1 (*Continued*)

Plant	Part used	Compound	Reference
Cedrelopsis grevei	Trunk bark	Coumarins, 7-methoxy-5-prenyl coumarin (iso cedrelopsin) and 3,′4′-dihydrobraylin, along with five known coumarins (6,7-dimethoxy-5-prenyl coumarin obliquin, 8-methoxy obliquin aesculetin, cedrelopsin and scoparone)	Um et al., 2003
Chisocheton ceramicus	Barks	Limnoid ceramicine A	Mohamad et al., 2008
Chisocheton erythrocarpus	Barks	Limonoids, erythrocarpines A-E	Awang et al., 2007
		Limonoids, malayanine A and malayanine B	Chong et al., 2012
Chisocheton paniculata	Fruit	Meliacin 1,2-dihydro-6-acetoxy azadirone	Bordoloi et al., 1993
	Whole plant	Protolimonoids and limonoids arunachalin	Yadav et al., 1999
Chisocheton polyandrus	Leaves	Dammarane triterpenoids, dammara-20,24-dien-3-one and 24-hydroxydammara-20,25-dien-3-one	Chan et al., 2012
Chisocheton tomentosus	Bark	7α-Hydroxy-β-sitosterol (new), stigmasta-4,6-diene-3-one, stigmasterol and β-sitosterol	Najmuldeen et al., 2011
Chukrasia tabularis	Leaves	Sitosterol, melianone, scopoletin, 6-7-dimethoxy coumarin, quercetin and its 3-galactoside and tannic acid	Rastogi and Mehrotra, 1993
	Wood	Meliacins, chukrasin A, B, C, D and E	Rastogi and Mehrotra, 1993
	Stem bark	Phragmalin-type limonoids, tabulalin F	Jun et al., 2011
		19-nor limonoid incorporating a unique 7,10-c-lactone tabulvelutin A, tabulvelutin B	Yin et al., 2011
	Root bark	Phragmalin limonoids tabulalin and tabulalides A-E	Nakatani et al., 2004
	Seeds	3,30-Isobutyrate, 3-isobutyrate, 30-propionate of phragmalin, 12-acetoxy phragmalin	Rastogi and Mehrotra, 1993
		Linoleic, linolenic acid	Goel, 1998
Cipadessa baccifera	Leaves	Cipadessi n-type limonoids, cipaferens A-D, and asmelianodiol, spicatin	Siva et al., 2013a
	Seeds	Cipadesin, 17α, 20R-dihydroxy pregnan-3,16-dione, 1,4-epoxy-16-hydroxy heneicos-1,3,12,14,18-pentaene and 1,4-epoxy-16-hydroxy heneicos-1,3,12,14-tetraene	Luo et al., 2000b
		Cipadesin and febrifugin	Marpaung et al., 2001
		Methyl angolensate type cipaferen E-J and three new mexicanolide-typelimonoids cipaferen K-M	Siva et al., 2013b
Cipadessa boivinina	Stem bark	Sesquiterpenoid; boivinianin A (11,12,13-trisnorbisabola-1,3,5-trien-10,7-olide); boivinianin B (7,10-epoxy-1,3,5-bisabolatrien-11-ol); 4-hydroxy-4,7-dimethyl-1-tetralone	Mulholland et al., 2006
Dysoxylum beddomei	Leaves	Beddomeilactone, beddomeilactone together with six known triterpenoids (3-oxo tirucalla-7,24-dien-23-ol, dipterocarpol, niloticin, melianone, melianodiol and 24-epi-melianodiol)	Hisham et al., 2004
Dysoxylum binectariferum	Stem bark	Rohitukine	Mohanakumara et al., 2010
		Dysoline, a regioisomer of rohitukine and rohitukine-*N*-oxide	Jain et al., 2013
Dysoxylum cumingianum	Leaves	Triterpenes cumingianol A-E and a triterpene glucoside Cumingianoside R and hispidol B, 21-*O*-methyltoosendanpentol andagladupol A	Kurimoto et al., 2011
Dysoxylum densiflorum	Twigs leaves	Three degraded limonoids, dysodensiols A-C, and three sesquiterpenoids, dysodensiols D-F, along with seventeen known compounds	Xie et al., 2008
Dysoxylum grande	Leaves	23-Oxo-cholestane derivatives grandol A-G along with a new 3, 4-secodammar-4(28)-en-3-oic acid derivative	Wah et al., 2013
Dysoxylum hainanense	Bark	Tirucallane derivatives. 3β, 22S-dihydroxy tirucalla-7,24-dien-23-one, 22,23-epoxy-tirucalla-7-ene-3β, 24,25-triol, 3β,25-dihydroxy-tirucalla-7,23-diene, 23,26-dihydroxy-tirucalla-7,24-diene-3	Luo et al., 2000c
		Ent-pimarene diterpenoids, ent-18-acetoxy-8(14)-pimarene-15S, 16-diol, ent-18-acetoxy-16-hydroxy-8(14)-pimarene-15-one, ent-16, 18-hydroxy-8(14)-pimarene-15-one, ent-19-nor-4,16, 18-trihydroxy-8(14)-pimarene-15-one together with three known damarane triterpenoids, richenoic acid, eichlerianic acid and shoreic acid.	Luo et al., 2001
		Apo-tirucallols 7α-acetoxyl-17α-20S-21,24-epoxy-apotirucall-14-ene-3α,23R,24S,25-tetraol (2), 7α-acetoxyl-17α-20S-21,24-epoxy-apotirucall-14-en-3-one-23R,24S,25-triol	Luo et al., 2002
		Nor-dammarane triterpenoids, 12β-*O*-acetyl-15α, 28-dihydoxy-17β-methoxy-3-oxo-20,21,22–23,24,25,26,27-octanordammanran, 12β-*O*-acetyl-15α,17β,28-trihydoxy-3-oxo-20,21,22–23,24,25,26,27-octanordammanran, 12β-*O*-acetyl-15α,28-dihydoxy-3-oxo-17-en-20,21,22–23,24,25,26,27-ctanordammanran, and 12β,15α,17β,28-tetrahydoxy-3-oxo-20,21,22–23,24,25,26,27-octanordammanran	Wang and Guan, 2012

Box 1 (*Continued*)

Plant	Part used	Compound	Reference
Dysoxylum kuskusense	Fruits	Prenyleu desmane diterpenes, dysokusone I and dysokusone E	Duh et al., 2000
Dysoxylum lenticellare	Stem	2α-methoxycomosivine, 2α-methoxy lenticellarine and 2α-hydroxylenticellarine	Aladesanmi and Hoffmann, 1994
		Biflavonoid, robusta flavone 4′,7″-dimethyl ether, Isoginkgetin, bilobetin	He et al., 1996
Dysoxylum macranthum	Bark	Triterpenes, dymacrins, A-Ktetracyclic terpenes and pregnane steroids	Mohammad et al., 1999b
Dysoxylum malabaricum	Leaves	Dammarane triterpenoid dymalol	Govindachari et al., 1994
		(20S,24R)-epoxy-4-hydroxy-3,4-secodammaran-3-oic acid methyl ester (along with two known dammarane triterpenoids)	
		Ergostane, ergosta 5,24 (24′)-diene-3β,4β, 20s-triol,	Govindachari et al., 1997
		(24R)-cycloartane-3β-24,25-triol and ergosta-5,24 (24′)-diene-3β, 7β-diol	
		Terpenes, 21R,23R-epoxy-21α-ethoxy-24S-25-dihydroxyapotirucall-7-en-3one	Hisham et al., 2001
		24R-acetoxy-3β,25-dihydroxy cycloartane	
Dysoxylum mollissimum	Leaves	Glabretal-type triterpenoids dysoxylumglabretol A (1a-1b), dysoxylumglabretol B (2a-2b) along with the known compounds,	Ragasa et al., 2013
		24,25-epoxy-3b,23-dihydroxy-7-tirucallene (3), squalene, polyprenol, linoleic acid and lutein	
Dysoxylum muelleri	Wood	Glabretal triterpenoids: Three dysoxins and also 6α-acetoxy-obacunone acetate (limonoid)	Mulholland et al., 1996
		Dammarane triterpenoids cabraleone, and richenone	Mulholland and Naidoo, 2000
Dysoxylum richii	Leaves	Dammarane triterpenoids	Aalbersberg and Singh, 1991
Dysoxylum schiffneri	Wood	Sesquiterpenoids (+)-8-hydroxy calamene, schiffnerone A (1,5-dihydroxy-1,3,5-bisabolatrien-10-one), trisa oresquiterpenoid, schiffnerone B (2-hydroxy-11,12,13-trinor-7-calamenone)	Mulholland et al., 1998a
Dysoxylum spectabile	Bark	Pimaradiene compounds, 6α-acetoxyobacunol acetate, methyl ivorensate, isopimara-8(14),15-diene, and 7α-hydroxyisopimara-8(14),15-diene	Mulholland et al., 1999b
Ekbergia benuguelensis	Root bark	4-Methoxy-5-hydroxy methyl coumarin, together with poly hydroxy squalenes. 2,3,22,23-tetrahydroxy-2,6,10,15,19,23-hexamethyl-6,10,14,18-tetra cosa tetraene and 2-hydroxymethyl-2,3,22,23-tetrahydroxyl-6,10,15,19,23-penta methyl-6,10,14,18-tetracosatetraene	Jonker et al., 1997
Ekbergia capensis	Dried bark	Triterpenoids, 2,3,22,23-tetra hydroxy 2,6,10,15,19,23-hexamethyl-6,10,14,18-tetracosatetraene and 2-hydroxy, methyl-23,22,23-tetrahydroxy 6,10,15,19,23-penta methyl-6,10,14,18-tetra cosa tetraene	Nishiyama et al., 1996
	Seed	Capensolactones 1-3 and methyl 3α-hydroxy-3-deoxy angolensate	Mulholland and lourine, 1998
Ekebergia pterophylla	Leaves	Lupeol	Mulholland et al., 1998b
	Bark	Pterophyllins 1 and 2 and known atraric acid, β-amyrin, β-amyrone, oleanonic acid, β-sitosterol, β-sitosteryl acetate and the	
	Wood	Pterophyllins 3-5	
Entandrophragma angolense	Leaves	Tirucallane triterpenoidal compounds 3,23-dioxotirucalla-7,24-dien-21-al, 3,4-secotirucalla-23-oxo-4(28),7,24-trien-21-al-3-oic acid and 3,4-secotirucalla-23-oxo-4(28),7,24-trien-3,21-dioic acid (21-methyl ester)	Orisadipe et al., 2005
	Root bark	Two gedunin type limonoids 5-hydroxy-7-deacetoxy-7-oxogedunin and 5,6-dehydro-7-deacetoxy-7-oxogedunin, and three methyl angolensate derivatives, 6-deacetoxydomesticulide D, 6-deacetoxydomesticulide D 21-methylether, and entangosin, together with known compounds, methyl angolensate, 6-acetoxymethyl angolensate and secomahoganin	Nsiama et al., 2011
Entandrophragma cylindricum	Bark	Sesquiterpenes 3-hydroxy-copa-2-en (oil) and 2α-hydroxy-copa-3-en	Daniewski et al., 1996
		Acyclic triterpene derivatives named sapelenins G-J, along with eight known compounds, sapelenins A-D, ekeberin D2, (+)-catechin and epicatechin and anderolide G	Kouam et al., 2012
Entandrophragma delevoyi	Stem bark	Delevoyin A (3,4-secotirucallane 4 (28),3-oic acid) and delevoyin B (6α-acetoxykinadealactone)	Mulholland et al., 1994
	Bark	Acyclic triterpenoid, sapelenin D	Ngnokam et al., 1995
		A novel tetranortriterpenoid, delevoyin C.	Mulholland et al., 2000b
	Wood	Gedunin and 11β-acetoxygedunin	Mulholland et al., 2000b
Entandrophragma utile	Bark	A new heptanortriterpenoid, entilin D	Daniewski et al., 1995
		New sterol, 7α,20(S)-dihyroxy-4,24 (28)-er-gostadien-3-one	Tchouankeu et al., 1996
Guarea macrophylla	Leaves	Terpenes guai-6-en-10β-ol, isopimara-7,15-dien-2α-ol and cycloarta-23,25-dien-3-one.	Lago et al., 2000
		Cycloartane triterpenoids including two new derivatives 22,25-dihydroxy-cycloart-23E-en-3-one and 24-methylenecycloartane-3b,22-diol	Lago et al., 2002a
	Leaves essential oil	Terpenes: one monoterpene, 16 sesquiterpenes and 6 diterpenes	
	Leaves oil	Sesquiterpenes identified including hydrocarbon and oxygenated derivatives	Lago et al., 2005

Box 1 (*Continued*)

Plant	Part used	Compound	Reference
	Stem bark	Caryophyllene oxide, guai-6-en-10 β-ol, sphathulenol, aromadendrane-4α,10β-diol, aromadendrane-4α,10α-diol, alloaromadendrane-4α,10β diol, steroids: sitosterol and stigmasterol	Lago et al., 2002a
	Bark volatile oil	17 Sesquiterpenes, one diterpene and four fatty acids	
Guarea guidonia	Volatile oil	Sesquiterpene (2S*)-eudesma-5,7-dien-2-ol	Lago et al., 2002b
	Leaves	Triterpenes (23S*)-cycloart-24-ene-3b,23-diol and (23R*)-cycloart-24-ene-3b,23-diol	
	Wood bark	Limonoid (mombasol) acoumari (scopoletin) and sesquiterpenes	Garcez et al., 1998
	Stem bark oil	Sesquiterpenes, β-caryophyllene, germacrene	Nunez and Roque, 1999
Guarea rhophalocarpa	Leaves	Terpenes including two sandara copimaradiene diterpenoids, ent-8-(14), 15-sandaracopimaradiene-2α,18-dioland ent-8-(14),15-sandaracopimaradiene-2β 18-dioland two lanostane triterpenoids,23-hydroxy-5α-lanosta 7,9(11),24-triene-3-one and 5α-lanosta-7,9(11),24-triene-3α,23-diol	Del Rayo et al., 2001
Guarea trichilioides	Dried leaves	Cycloartane derivatives-cycloart-24-en-3,23-dione, 23-hydroxycycloart-24-en-3-one (epimers), 3β-hydroxycycloart-24-ene-23-one, 25-hydroxycycloart-23-en-3-one, 3β-21-dihydroxycycloartane, 3β-21,22,23-tetra hydroxycycloartane-24 (31)25-diene	Furlan et al., 1993
	Leaves	Diterpenoids including four labdane and two clerodane derivatives	Furlan et al., 1996
	Fruits	Diterpenoids including four labdane and two clerodane derivatives	Wolter et al., 1993
Khaya anthotheca	Stems	Acyl peroxylated and seco-mexicanolides 1α,8α-oxido-3β-acetoxy-2α, 14α-dihydroxy-{3,3.110,2}-bicyclo meliac-7,19-olide and 3-acetoxy 8,14-dien-8,30-sec-khayalactone, methyl 1 α, 2β 3α, 6,8α, 14β-hexahydroxy {4.2.110.30. 11,4}-tricyc lomeliac-7-oate scopoletin and 3-β-d-gluco pyranosyl sitosterol	Ferreira et al., 2005
	Stem bark	Anthothecanolide, 3-*O*-acetyl anthothecanolide, 2,3-di-*O*-acetyl anthothecanolide, 6R, 8α-dihydroxycarpin, 3β-acetoxy-3-deoxo-6Rhydroxycarpin, methyl angolensate, methyl 6-hydro angolensate, khayalactone	Tchimene et al., 2005
Khaya grandifoliola	Trunk bark	A,B,D-Secolimonoid, khaya lactone ($C_{27}H_{34}O_9$)	Tchuendem et al., 1998
	Stem bark	Deacetylkhayanolide E, 6S-hydroxykhayalactone, and grandifolide A and khayanolide A, anthothecanolide, 3-*O*-acetylanthothecanolide	Zhang et al., 2008
Khaya ivorensis	Seeds	Limonoid	Vanucci et al., 1992
	Stems	1-*O*-Deacetyl-6-deoxykhayanolide E, 1-*O*-deacetyl-2a-hydroxykhayanolide E, 3-acetyl-khayalactone, 11a-acetoxy-2a-hydroxy-6-deoxy-destigloylswietenine acetate,	Zhang et al., 2009
Khaya senegalensis	Stem bark	Rings B and D opened limonoids, rings B and D opened limonoids, khayanone and 2-hydroxy seneganolide and phragmalin limonoid 1-*O*-acetyl khayanolide	Nakatani et al., 2001
		Phragmalin-type limonoids, khayanolides A, B and C, four B,D-seco compounds, seneganolide, methyl angolensate and its 6-hydroxy and 6-acetoxy derivatives	Abdelgaleil et al., 2001
		B/D opened limonoids, phragmalin limonoids khayanolides D and E and one limonoid glucoside, khayanoside	Nakatani et al., 2002
	Bark	2,6-Dihydroxy fissionolide	Khalid et al., 1998
		Tetranottriterpenoids of mexicanolide type: 2-hydroxymexicanolide, 6-deoxy destigloylswietenine, 2,3-dihydroxy-3-deoxymexicanolide	Govindachari et al., 1998
	Leaves	Methyl-1α-acetoxy-3β,6,8α-trihydroxy-2α-methoxy-2β,14β-epoxy-tricyclomeliac-7-oateand methyl 1α-acetoxy-6,8α, 14β,30β-tetrahydroxy-3-oxo-tricyclomelin-C-7-oate	Olmo et al., 1997
	Seeds	Mexicanolide tetranortriterpenoids 2-hydroxymexicanolide, 6-deoxydestigloylswietenine and 2,3-dihydroxy-3-deoxymexicanolide. In addition, mexicanolide, 3β-hydroxy-3-deoxymexicanolide, 3β-hydroxy-3-deoxycarapin, 6-hydroxy methyl angolensate, 3-acetyl-7-keto khivorin, 3-deacetyl khivorin and 3,7-dideacetyl khivorin	Govindachari and Krishna Kumari, 1998
Malleastrum antsingyense	Stem bark	Vilasinin limonoids 1,3-diacetylvilasinin, 1,3-diacetyl-12a-hydroxy-7-tigloylvilasinin	Coombes et al., 2008
Melia azedarach	Leaves	Meliacarpin derivatives (C-seco limonoids) 1,3-dicinnamoyl-11-hydroxymeliacarpin,1-cinnamoyl-3-methacrylyl-11-hydroxy-meliacarpin and 1-cinnamoyl-3-acetyl-11-hydroxymeliacarpin.	Bohnenstengel et al., 1999
		Dipenta decylketone, glycerol 1,3-bis-undec-9-enoate 2-do-dec-9-enoateand glycerol tris-tri dec-9-enoate	Suhag et al., 2003
		Steroids (20*S*)-5,24(28)-ergostadiene-3α,7α,16β,20-tetrol (1), (20*S*)-5-ergostene-3β,7α,16β,20-tetrol (2), and 2α,3β-dihydro-5-pregnen-16-one and 5-stigmastene-3β,7α, 20-triol, 5-stigmastene-3β,7α-diol, and 2α,3α,16β-trihydroxy-5α-pregnane 20R-methacrylate	Wu et al., 2009
	Stem	12-hydroxy amoora statone, 12-hydroxy amoora statin, 12-acetooxy amoora statin	Ahn et al., 1994
	Roots	Teracrylmelazolide A, melazolide A and teracrylmelazolide B	Ambrosio and Guerriero, 2002
		Limonoids, azecins 1, 2, 3 and 4	Srivastava and Gupta, 1985

Box 1 (*Continued*)

Plant	Part used	Compound	Reference
	Root bark	Azadarariade 12α-acetoxy fraxinellone, fraxinellone, fraxinellonone	Nakatani et al., 1998
		Salannai, meliacarpinin E, salannin, nimbolinin B, nimbolidin B	Ruo Chun et al., 1996
		Azadarachin C	Huang et al., 1995
		Azadirachtin type limonoids: 1-tigloyl-3,20-diacetyl-11-methoxy meliacarpinin, 3-tigloyl-1,20-diacetyl-11-methoxy meliacarpinin, 1-cinnamoyl-3-hydroxy-11-methoxy melia carpinin, 1-deoxy-3-methacrylyl-11-methoxy meliacarpinin, 1-cinnamoyl-3-acetyl-11-methoxy melia carpinin	Takeya et al., 1996
		Azadirachtin type limonoids, 1-tigloyl-3-acetyl-11-methoxymeliacarpinin and 1-acetyl-3-tigloyl-11-methoxy meliacarpinin, sendanin type limonoids, 29-iso butyl sendanin, 12-hydroxy amoorastin, 29-deacetyl sendanin	Itokawa et al., 1995
		Trichilin H, 12-acetyltrichilin B, 7,12 diacetyl trichilin B, trichilin B and D, meliatoxin A2	Nakatani et al., 1994
	Fruit	Meliarttenin	Carpinella et al., 2002
		Limonoids and one tirucallane-triterpenoid	Akihisa et al., 2013
	Ripe fruits	C-Seco limonoids and new tetracyclic limonoids	Zhou et al., 2005
		New ring C-seco limonoids	Zhou et al., 2004
Melia dubia	Bark	Meliastatins 1-5	Pettit et al., 2002
	Roots	Tetranortriterpenoids	Puroshothaman et al., 1984
Melia composita	Roots	Anthroquinones and glycosyl derivative of ellagic acid	Srivastava and Srivastava, 1996
Melia toosendan	Stem bark	Trichilins K and L, along with five known limonoids, trichilins H, I and J, azedarachin A and 12-*O*-acetyl-azedarachin B.	Zhou et al., 1996
	Root bark	Ring C-seco limonoids, 3-*O*-acetylohchinolal, ohchinolide C and nimbolidin F, salannin, azadirone and acetyl trichilenone	Zhou et al., 1997
		Limonoids with a C-19/C-29 bridged acetyl trichilin H 29-*O*-substituted amoorastatone derivatives neoazedarachins A, B and D	Zhou et al., 1998
		Limonoids spirosendan, trichilinin D-E, and 1-deacetylnimbolinin A, nimbolinin B and its 1-deacetyl derivative	Nakatani et al., 1999
	Fruits	Toosendanal and 12-*O*-methylvolkensin, meliatoxin B, trichilin H and toosendanin	Tada et al., 1999
		12-*O*-methyl-1-*O*-deacetylnimbolinin B, 12-*O*-methy-1-*O*-tigloyl-1-*O*-deacetylnimbolinin B, 12-*O*-ethylnimbolinin B, and 1-*O*-cinnamoyl-1-*O*-debenzoylohchinal and tirucallane-type triterpenoids, meliasenins S and T	Hu et al., 2011
		Meliatoosenins E-S	Zhang et al., 2012b
		Nimbolinin-type limonoids, 12a/b-1-*O*-tigloyl-1-*O*-deacetyl-nimbolinin B, 1-deacetylnimbolininB, nimbolinin B and nimbolinin A	Su et al., 2013
		Limonoids	Zhang et al., 2013b
Melia volkensi	Root bark	Apotirucallane triterpenes meliavolkensins A and B, toosendanin and meliavolen, melianinone, 3-episapelin A, nimbolin B	Zeng et al., 1995a
		Meliavolin, apotirucallane triterpene, and meliavolkin, tetranortriterpene, together with melianin A,	Zeng et al., 1995b
		Ring C-seco limonoids, nimbolidins C-E along with known Seco-limonoids, nimbolidin B and salannin	Nakatani et al., 1996
		Volkensinin ($C_{32}H_{42}O_{11}$)	Rogers et al., 1998
	Seeds	Antimyco bacterial triterpenes, 12β-hydroxykulactone(1)6β-hydroxykulactone (2)	Cantrell et al., 1999
Melicope semecarpifolia	Leaves	Furoquinoline alkaloids and cytotoxic constituents. Meliacarpine, semecarpine and (+/−)-8-methoxyplatydesmine, together with flavone ayanin	Chen et al., 2003
Munronia delavayi	Whole plants	Limonoids, mulavanins A-E, along with four known compounds 2α,3α,15β-trihydroxy-20(S)-tigloyl-pregnane, mombasol, 14,15β-epoxyprieurianin and nymania 3	Lin et al., 2010
Munronia henryi	Whole plant	A,B-seco-tetranortriterpenoid lactam, munroniamide	Qi et al., 2003
		Limonoids munronolide, munronolide 21-*O*-β-d-glucopyranoside	Zhang et al., 2004
Munronia unifoliolata	Whole plant	Limonoids, named munronoids A-J	Ge et al., 2012
Neobeguea leandreana	Stem bark	Phragmalin limonoids leandreanins A, B and C	Coombes et al., 2003
Neobegueae mahafalensis	Bark	Limonoid, neobeguin, and β-amyrin and stigmasterol	Randrianarivelojosia et al., 1999
	Seed shells	Three triterpenoids, sapelin C, sapelin E acetate and grandifoliolenone	Naidoo et al., 2003
	Seed	Methyl angolensate, mexicanolide and khayasin	
Owenia cepiodora	Leaves and bark	Limonoid, 28-deoxonimbolide, and three protolimonoids, 24S,25-dihydroxytirucall-7-en-3-one, 3-oxo-tirucalla-7, 24-dien-21-al and 21,24R-epoxy-25-hydroxytirucall-7-en-3-one	Mulholland et al., 1998c
Quivisia papinae	Seeds	Limonoid quivisianthone, and 6a-hydroxyazadiradione and 7-deacetyl-7-angeloyl-6ahydroxyazadiradione, azadiradione	Coombes et al., 2004.
		Mexacanolide limonoids, quivisianolideA, quivisianolideB and quivisianone	Coombes et al., 2005.

Box 1 (*Continued*)

Plant	Part used	Compound	Reference
Sandoricum indicum	Stem bark	Multiflorane-triterpenoid acids 12β-hydroxy multiflorane triterpenoid acids, sandorinic acids A-C	Tanaka et al., 2001
Sandoricum koetjape	Leaves	Trijugin type limonoids, sandrapins A, B and C	Ismail et al., 2003
		Analogues of trijugin type limonoids sandrapins D and E	Ismail et al., 2004
		Andirobin-type limonoids, named sandoripin A and sandoripin B	Pancharoen et al., 2009
	Stem bark	Secomultiflorane type triterpenoid acids, bryonic acid and two new ring-A seco triterpenoids	Kosela et al., 1995
Soymida febrifuga	Root callus	Methyl angolensate and luteolin-7-*O*-glucoside	Chiruvella et al., 2007
	Bark	Phragmalin type limonoids soymidin A and B.	Ashok Yadav et al., 2012
Swietenia macrophylla	Leaves	Phragmalin ortho esters, named swietephragmin H-J, and polyhydroxylated phragmalin, swietemacrophine	Tan et al., 2009
	Fruits	Phragmalin-type limonoid, 6-*O*-acetyl-3′-demethylswietephragmin E	Chen et al., 2010
	Seeds	Tetranortriterpenoids	Kojima et al., 1998
		Limonoids; augustineolide, 3β-6 dihydroxy dihydrocarpin from *S. macrophylla* and 6-acetoxy humilinolide from aubrevillena	Mootoo et al., 1999
Swietenia mahagoni	Leaves	Scopoletin, melianone, cyclo mehogenol, swietenin, stigmasterol glucose	Rastogi and Mehrotra, 1993
		Phragmalin limonoids swietephragmins A-G, and two other different types of 2-hydroxy-3-*O*-tigloylswietenolide and deacetylsecomahoganin, methyl 6-hydroxyangolensate, swietemahonin G and 7-deacetoxy-7-oxogedunin	Abdelgaleil et al., 2006
		Phragmalin-type limonoids, swietephragmin H, swietephragmin I and 11-hydroxyswietephragmin B, and a mexicanolide-type limonoid 2-hydroxy-6-deacetoxyswietenine 6-*O*-acetyl-2-hydroxyswietenin, 2-hydroxyswietenine, swietemahonin G, methyl 6-hydroxyangolensate and 7-deacetoxy-7-oxogedunin	Abdelgaleil et al., 2013
	Twigs and leaves	Limonoids, swiemahogins A and B	Chen et al., 2007
	Stem bark	Phragmalin 8,9,14-orthoacetate with the addition of methyl 2,30-orthoacetate or a propionate, swietenialides A, B, and C and two ring-D opened phragmalin-type 1,8,9-orthoacetates, swietenialides D and E, mexicanolide, 2-hydroxyswietenin	Saad et al., 2003
	Heart wood	Cyclo swietenol, lupleol, benzoate hedergenin, cycloartenol, β-sitosterol	Rastogi and Mehrotra, 1993
	Seeds	6-Desoxyswietenine	Govindachari et al., 1999a
Toona ciliata	Leaves	Limonoids, toonayunnanins A-L	Liu et al., 2012
	Leaves and stems	Siderin, 4,6,7-trimethoxy-5-methylcoumarin, isoscopoletin, scopoletin, 6,7-dimethoxycoumarin, 7-hydroxy-6,8-dime-thoxycoumarin, dehydrodiconiferyl alcohol, (−)-lariciresinol, *thero*-2,3-bis-(4-hydroxy-3-methoxypheyl)-3-methoxy-propa-nol, cycloeucalenol, 8(14), 15-isopimaradiene-2,3,19-triol, 3*S*,5*R*-dihydroxy-6*R*, 7-megstigmadien-9-one, (−)-loliolide, (+)-catechin, dimethyl malate, diisobutyl phthalate, dibutyl phthalate, 1,3,5-trimethoxybenzene, syringic acid, syringaldehyde, vanillic acid, vanillin, and 3,3′,5,5′-tetra-tert-butyl-2,2′-dihydroxybiphenyl	Liu et al., 2011a
	Stem	Toonacilianins A-J, and two norlimonoids, toonacilianins K and L	Liu et al., 2011b
	Stem bark	Five new pregnane steroids, toonasterones A, B, (Z)-aglawone, (Z)-toonasterone C, and (E)-toonasterone C	Wang et al., 2011
Toona microcarpa	Stem and bark	A flavanone, (+)-catechin, two lignans, (6R,7S,8S)-7a-[(β-d-glucopyranosyl)oxy]lyoniresinol and (6R,7R,8R)-7a-[(β-d-glucopryanosyl) oxy]lyoniresinol and a steroid 20-hydroxyecdysone	Fang et al., 2010
Trichilia americana	Stem	Steroid 2-hydroxyandrost-1,4-dien-3,16-dione (trichiliasterone B)	Hantos et al., 2001
Trichilia casaretti	Leaves	β-sitosterol, stigmasterol	Faaaigueiredo, 2010
Trichilia catigua	Bark	Gamma lactones and its precursors omega-phenylalkanes, three omega phenyl alkanoic acids. Five omega-phenyl-gamma lactones, two alkyl-gammalactones, one alkenyl-gamma lactone and mixture of fatty acids ranging from C-14 to C-26	Pizzolatti et al., 2004
	Whole plant	7-Hydroxy-1-oxo-14-norcalamenene, 7,14-dihydroxy calamenene, sitosteryl-β-δ-glucopyranoside	Garcez et al., 1997a
	Fruits	Meliacin-type limonoids fotogedunin A, B	Matos et al., 2009
	Seeds	Methyl angolensate, 11β-methoxycedrelone	Matos et al., 2007
Trichilia claussenii	Leaves	24-Methylene-26-hydroxycycloartan-3-one, 24-methylene cycloartanol fatty acids derivatives, caryophyllene epoxide, a mixture of ω-phenyl alkanoic and alkenoic acids, plastocromenol,α-tocopherol, squalene and a mixture of sitosterol and stigmasterol	Pupo et al., 1996
		3-*O*-β-glycopyranoside sitosterol, 3-*O*-β-glycopyranoside stigmasterol	Pupo et al., 1997
		β-Sitosterol etherified, stigmasterol etherified	Pupo et al., 2002
	Fruits	γ-Lactones (2R,3S,4S)-3-hydroxy-4-methyl-2-(13′-phenyl-1′-n-tride cyl)-butanolide. (2R,3S,4S)-3-hydroxy-4-methyl-2-(11′-phenyl-1′-n-undecyl)-butanolide. (2R,3S,4S)-3-hydroxy-4-methyl-2-(1′n-hexa dec-7′(z)-enyl)-butanolide and (2R,3S,4S)-3-hydroxy-4methyl-2-(1′-n-tetra decyl)-butanolide	Pupo et al., 1998

Box 1 (*Continued*)

Plant	Part used	Compound	Reference
	Wood	2α,3α-dihydroxyandrostan-16-one-2β,19-hemiketal,2α,3β-dihydroxypregnan-16-one-2β,19-hemiketal,2β,3β,4β-trihydroxypregnan-16-one,2α,3α,4β-trihydroxypregnan-16-one, 2β,3β-dihydroxypregnan-16-one	Pupo et al., 1997
Trichilia connaroides	Leaves	Heynic acid and 24-methylene cycloartane-3β, 21-diol	Rastogi and Mehrotra, 1993
	Leaves	Methyl 11′,13′-dioxo-12′-aza-[4,4,3]-pro, 4a,8a-(methaniminomethano)naphthalene-9,11, naphthalene, bicyclo[3.1.1],2,6,6-trimethyl heptan-3-one, isotridecanol, 7-tetradecene, octane, 1-bromo-2-chloro-1,1-difluro-2-tridecan (hexacosane), tetrahydroxy myrcenol, dodecyl acrylate (oleic acid), 1-(1,5-dimethyl)-4-hexyl-4-methyl benzene, 17-pentatriacontane, 2,4-bis(1,1-dimethylethyl) phenol, silane-trichlorodocosyl, -undecanethiol,2-methyl, pentadecane, undecane, decane, hydroxylamine, *o*-decyl, dodecanoic acid, 2-hexyl-1-octanol, germacrane-B, erucic acid, phthalic acid, cyclobetyl octyl ester, nonadecane, hexadecanoic acid methyl ester (palmitic acid), serverogenin acetate, dotriacontane, isochiapin B, phytol, oleic acid, ethyl linoleate, ethyl oleate, 2-(3-innoxyl)3-5-aminopyridol (2,3-dipyrimidine), 4,4′,6,6′-tetra-butyl *O,O′*-biphenol, eicosane, phthalic acid octyl tridec-2-yn-1-yl ester, 6,10,14,18,22-tetra cosa pentane 2-ol, 3-bromo,2,6,10,15, lycopersen, solanesol	Senthilkumar et al., 2012
	Twigs and leaves	Trijugins D-H and methyl 8a-hydroxy-8,30-dihydroangolensate, two degraded limonoids, trichiconnarins A and B, and a pregnane steroid, 3b,4a-dihydroxypregnan-21-one, along with the known trijugin C and 3b,4a-dihydroxypregnan-16-one	Wang et al., 2008
	Pericarp	Mexicanolide type limonoid, 2-hydroxy-3-*O*-tigloyl-6-*O*-acetyl swietenolide and tirucallane type triterpenoid derivative, lipo-3-epi sapelin A	Inada et al., 1994
Trichilia cuneata	Stem and leaves	13-acetoxy-14-nordehydrocacalohastine, maturinone	Doe et al., 2005
Trichilia dregeana	Stem	Limonoids with furan-ringdregeana-5, dregeanin, 12-(2′-deacetyl)-dregeanin	Connolly et al., 1976
	Seeds	Limonoids with furan-ring, dregeana 1-4, hispidin C	Mulholland and Taylor, 1980
Trichilia elegans	Seed and bark	*seco-A* ring protolimonoids	Garcez et al., 1996
	Seeds	Limonoids seco-A, B and D carbocyclic rings, kihadanin A and B, 3-*O*-β-d-glucopyranosyl-sitosterol	Garcez et al., 1997b
	Seeds	7-Deoxo-7β-acetoxykihadanin A, B, 7-deoxo-7β-hidroxykihadanin A, B, 7-deoxo-7α-hidroxykihadanin A, 7-deoxo-7α-acetoxykihadanin A, B	Garcez et al., 2000
Trichilia emetica	Stem bark	Nymanial, drageane 4, trichilin A, rohituka 3, trichilin B and a protolimonoid	Gunatilaka et al., 1998
	Roots	Four pregnanes: 1-methoxy-pregnan-17(R)-1,4-dien-3,16-dione, 1-methoxy-pregnan-17(S)-1,4-dien-3,16-dione, 2,3-seco-pregnan-17(S)-2,3-dioic acid-16-oxo-dimethyl ester, 2α,3α,16α-trihydroxy-5α-pregnan-17(R)-20-yl acetate, three androstanes: 1-methoxy-androstan-1,4-dien-3,16-dione,2,3-seco-androstan-2,3-dioic acid-16-oxo-dimethyl ester, 3-methoxycarbonyl-2,3-seco-androstan-3-oic acid-16-oxo-2,19-lactone, pregnane derivatives 2α,3α,16α,20-tetrahydroxy-5α-pregnane, 2β,3β-dihydroxypregnan-16-one, 2β,3α-dihydroxypregnan-16-one	Malafronte et al., 2013
Trichilia estipulate	Leaves	7-oxo-24α-sitosterol, β-sitosterol, sitosterone	Cortez et al., 1998a
	Bark	Lignan glycosides. (−)-isolariciresinol-3α-*O*-β-d-xylopuranoside, (−)-lyoniresinol-3α-*O*-β-d-xylopyranoside and the new lignans (+)-4′-*O*-methyl-9′-deoxy isolari ciresinol-3α-*O*-β-d-glucopyranosi de, (−)-lyoniresinol-3α-l-rhamnopyranoside	Cortez et al., 1998b
		Meliacin butenolides, 7a-23-dihydroxy-3-oxo-24,25,26,27-tetranorapotirucall-1,14,20(22)-trien-21,23-olide, 7-deacetyl-23-hydroxyneotrichilenonelide and 7-deacetyl-21-hydroxyneotrichilenonelide, together with scopoletin, isofraxidin, 7-oxo-24β-, 7-oxo-24α-sitosterols and 3β-*O*-β-d-glucopyranosylsitosterol	Cortez et al., 1998a
		Limonoid 21,24,25,26,27-pentanor-15,22-oxo-7a,23-dihydroxy-apotirucalla(eupha)-1-en-3-one	Cortez et al., 2000
	Stem bark	21,24,25,26,27-pentanor-15,22-oxo-7α,23-dihydroxy-apotirucalla-1-en-3-oen	Cortez et al., 2000
Trichilia havanensis	Seeds	Tetranortriterpenoid 1β,2β: 21,23 diepoxy 7α-hydroxy-24,25,26,27 tetranor-apotirucalla-14,20,22-trien-3-one	Rodriguez et al., 2003
		Trichavensin	Rodriguez-Hahn et al., 1996
		Hydroxybutenolide	Arenas and Rodrigues-Hahn, 1990
	Stem	Limonoid *neo*-havanensin	Chan et al., 1967
	Stem and fruit	Limonoid triacetyl-havanensin, trichilenone acetate	Chan et al., 1967
	Fruits	Carda-14,20(22)-dienolide-1,3,7-*tris*(acetyloxy)-21-hydroxy-4,4,8-trimethyl-α,3α,5α,7α,13α,17α,21*R*	Arenas and Rodrigues-Hahn, 1990

Box 1 (*Continued*)

Plant	Part used	Compound	Reference
		Limonoid 3,7-diacetyl-havanensin, havanensin	Chan et al., 1967
Trichilia hirta	Fruits	Hirtinone, six protolimonoids – nilocitin, dihydronilocitin B, melianone epimers, piscidinol A, melianone lactone, one tertranortriterpenoid, hirtin, and one sesquiterpene, spathulenol	Vieira et al., 2013
		A limonoid methyl-11β-acetoxy-6,23-dihydroxy-12α(2-methylpropionyloxy)-3,7,21-trioxo-1,5,14,20-meliacatetraen-29-oate	Cortez et al., 1992
	Seeds and leaves	Hirtine	Chan and Taylor, 1966
	Seeds and fruits	Deacetylhirtine, azadirone	Chan and Taylor, 1966
Trichilia lepidota	Leaves	Terpenes: epoxide caryophyllene, epoxide humulene, spathulenol and steroids: ergost-5,24(28)-dien-3,12-diol-(3β,12β), ergost-5,24(28)-diene-3,12-diol-3-hexadecanoate (3β,12β), 24-methyl-12-β-hydroxycolest-4-en-3-one, 24-methylen-colesterol	Pupo et al., 2002
Trichilia pallida	Leaves	24-methylen-3β,4β,22-trihydroxycolesterol, 24-methylen-3β,22-dihydroxycolesterol, 24-methylen-colesterol	Cunha et al., 2008
	Roots	Tetranortriterpnoids 6-hydroxy-11β-acetoxy-12α-(2-methyl propanoyloxy)-3,7-dioxo-14 β,15β-epoxy-1,5-meliacadien-29-oate, methyl 6,11 β-dihydroxy-12α-(2-methyl propanoyloxy)-3,7-dioxo-14β,15β-epoxy-1,5-meliacadien-29-oate and methyl 6-hydroxy-11β-acetoxy-12α-(2-methylbutanoyloxy)-3,7-dioxo-14β,15β-epoxy-1,5-meliacadien-29-oate	Simmonds et al., 2001
Trichilia prieuriana	Leaves	Protolimonoid glucoside, prieurianoside, and glycolipid 1,2-dilinolenoyl-3-galactopyranosylglycerol	Olugbade and Adesanya, 2000
	Stem	Prieurianin acetate and prieurianin	Gullo et al., 1975
Trichilia quadrijuga	Leaves	Terpenes: kudtdiol, spathulenol and steroids, β-sitosterol, itesmol, stigmasterol	Rodrigues et al., 2009
Trichilia rubra	Root	Three minor limonoid components, rubralins A-C	Musza et al., 1995
		Limonoids rubrin A, B, C, D, E, F and G	Musza et al., 1994
Trichilia rubescens	Leaves	trichirubun A, trichirubun B	Krief et al., 2004, 2006
Trichilia silvatica	leaves	(2*S*,3*S*,6*R*,7*R*)-humulene-2,3,6,7-diepoxide, (2*R*,3*R*,6*R*,7*R*)-humulene-2,3,6,7-diepoxide, mustacone	Souza et al., 2009
Trichilia welwitschii	Seeds	Limonoids, dregeanin DM4, rohituka 3 and trichilia lactone D5	Tsamo et al., 2013
	Bark	28,29-dinorcycloart-24-ene-3,4,6-triol (4), sitosterol-3-*O*-β-d-glucoside, 4-hydroxy-*N*-methyl-l-proline, stigmasterol and sitosterol	
Turraea floribunda	Seed	Limonoids and limonoid derivatives, turraflorins D-I, turraflorins A and B	McFarland et al., 2004
	Root bark	11β-acetoxy-3,7-diacetyl-4α-carbomethoxy-12α-isobutyryloxy-28-nor-1-tigloyl-havanensin	Torto et al., 1996
		Limonoids of the havanensis class	Torto et al., 1995
Turraea holstii	Stem and root bark	Triterpenoids, holstinone A. (21R,23R-epoxy-7α,24S-dihydroxy-21α,25-dimethoxyapotirucalla-1,14-dien-3-one), holstinone B (21S,23R-epoxy-7α,24S,25-trihydroxy-21β-methoxyapotirucalla-1,14-dien-3-one) and holstinone C (21R,23R-epoxy-7α,24S,25-trihydroxy-21α-methoxyapotirucalla-1,14-dien-3-one).	Mulholland et al., 1999c
Turraea parvifolia	Root bark	Vilasinin limonoids, 1α,3α-diacetylvilasinin, 1α-acetyl-3α-propionylvilasinin and 1α,3α-diacetyl-7α-tigloylvilasinin, and two azadirone limonoids mzikonone and 12α-acetoxy-1,2-dihydroazadirone	Cheplogoi and Mulholland, 2003a
	Seeds	Turraparvin A-D, 12α-acetoxyazadironolide, 11-epi-21-hydroxytoonacilide, 11-epi-23-hydroxytoonacilide	Cheplogoi and Mulholland, 2003b
Turraea pubescens	Twigs and leaves	Pregnane steroids, 2β,3β,5β-trihydroxy-pregn-20-en-6-one, 3β-hydroxy-5α-pregn-7,20-dien-6-one, and 3β-acetoxy-5α-pregn-7,20-dien-6-one	Wang et al., 2006
	Twigs	Steroids turranin A-C and one new sesquiterpene turranin F and two new natural products turranin D and E, as well as three known steroids villosterol, 3β-hydroxy-5α-pregn-7,20-dien-6-one, and 2β,3β,5β-trihydroxypregn-20-en-6-one	Yuan et al., 2013
Turraea wakefieldii	Root bark	Limonoids 11β,12α-diacetoxyneotecleanin, 11β,12α-diacetoxy-14β,15β-epoxyneotecleanin, 7α,12α-diacetoxy-14β,15β-epoxy-11β-hydroxyneotecleanin, 7α,12α-diacetoxy-11β-hydroxyneotecleanin, 11β,12α-diacetoxy-1-deoxo-14β,15β-epoxy-3β-hydroxy-2-oxo-neotecleanin	Ndung'u et al., 2003
Turraeanthus mannii	Root bark	(3R,4R,3′R,4′R)-6,6′-dimethoxy-3,4,3′,4′-tetrahydro-2H,20H-[3,3′]bichromenyl-4,40-diol and 15-acetoxy-labda-8(17),12E,14Z-trien-16-alcoumarin derivative, chromenone, two labdane diterpenes and one pregnane steroid	Sielinou et al., 2012
Turreanthus africanus	Seeds	Two labdane diterpenoids and seco-tetranortriterpenoid. 12,15-epoxylabda-8(17),12,14-trien-16al and 16-acetoxy-12(R), 15-epoxy-15β-hydroxylabda-8 (17), 13 (16)-diene and a limonoid 17-*epi* 12-dehydroxy heudebolin	Tane et al., 2004
Walsura chrysogyne	Barks	Limonoids walsogyne A	Mohamad et al., 2008
		Limonoids, Walsogynes B-G	Nugroho et al., 2013

Box 1 (*Continued*)

Plant	Part used	Compound	Reference
Walsura piscidia	Leaves	Piscidinol F, apotirucallane	Govindachari et al., 1995
	Aerial parts	Lup-20-(29)-ene-3β,30-diol and 5-hydroxy-7,3′,4′,5′-tetra methoxy flavones	Balakrishna et al., 1995
Walsura robusta	Leaves	Sesquiterpenoid 10β-nitro-isodauc-3-en-15-al, 10-oxo-isodauc-3-en-15-al	Li et al., 2013a
Walsura trichostemon	Roots	Apotirucallane, trichostemonate	Sichaem et al., 2012
Walsura trifoliata	Leaves and twigs	Apo-tirucallane triterpenoids, piscidinone A and B	Rao et al., 2012
Walsura yunnanensis	Bark	Walsurin, isowalsuranolide, 11β-acetoxy walsuranolide and 20,22-dihydro-22,23-epoxy walsuranolide and 11β-hydroxy dihydrocedrelone, 11β-acetoxy dihydrocedrelone	Luo et al., 2000d
Xylocarpus granatum	Bark	Friedelin, β-sitosterol, stigmasterol, methyl-3β-isopropyl-1-oxomeliacate, methyl-3β-acetoxy-oxomeliacate tria contanol	Rastogi and Mehrotra, 1993
		Phragmalin-type limonoids, xyloccensins Q-U along with xyloccensin P	Cui et al., 2005
		Three mexicanolides, xyloccensins L-N and eight 8, 9, 30-phragmalin ortho esters, named xyloccensins O-V	Wu et al., 2006
	Fruit	Xyloccensin K, W, aurantiamide, daucosterol, (β)-catechin, spicatin, 6-acetoxycedrodorin	Wu et al., 2006
	Seeds	Xyloccensin K	Kokpol et al., 1996
		Seven protolimonoids odoratone, grandifoliolenone, sapelin E acetate, holstinone B, C, hispidol B, piscidinol G	Yin et al., 2009
Xylocarpus moluccensis	Seeds	Xyloccensins A, B, C, D, E, F and methyl angolensate	Rastogi and Mehrotra, 1993
		Godavarins A-J along with eight known limonoids, viz. xyloccensins L, P, Q, mexicanolide, 6-deoxy-3-detigloyl-swietenine acetate, fissinolide, methyl 3β-acetoxy-1-oxomeliaca-8(30), 14-dienoate, and methyl 3β-acetoxy-1-oxomeliaca-8(9),14-dienoate	Li et al., 2010
		Thaixylomolins D-F	Li et al., 2013b

Box 2: Antibacterial and antifungal activity of Meliaceae members.

Plant name	Part used	Extract	Microbes used	Reference
Agalia congylos	Leaf and bark	Hexane, dichloromethane, methanol	*Saccharomyces cerevisiae*, *Escherichia coli*, *Bacillus subtilis*, *Bacillus cereus*	Jayasinghe et al., 2002
Aglaia cucullata	Leaf	Methanol, chloro-form:methanol, chloroform, Hexane	*Vibrio alginolyticu*, *Pseudomonas aeruginosa*, *Edwardsiella tarda*, *Pseudomonas fluorescens*	Choudhury et al., 2005
Amoora chittagonga	Whole plant	Methanol	*Bacillus cereus*, *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Vibrio parahemolyticus*, *Vibrio mimicus*, *Candida albicans*, *Saccharomyces*, *cerevisae*	Rahman et al., 2008
Amoora cucullata	Leaves and stem	Methanol	*Escherichia coli*, *Vibrio cholerae*, *Salmonella typhi*, *Salmonella paratyphi*, *Shigella dysenteriae*, *Shigella flexneri*, *Pseudomonas* spp., *Proteus* spp.	Ferdoushi et al., 2012
Aphanamixis grandifolia	Arial parts	Ethanol	*Staphylococcus aureus*	Yan-Jiao et al., 2013
Aphanamixis polystachya	Leaf	Petroleum ether, chloroform, ethyl acetate	*Bacillus subtilis*, *Bacillus megaterium*, *Sarcina lutea*, *Staphylococcus aureus*, *Salmonella typhi*, *Escherichia coli*, *Vibrio parahemolyticus*, *Shigella dysenteriae*	Ripa et al., 2012
	Fruit	Hexane, ethyl acetate, methanol	*Staphylococcus aureus*, *Shigella dysenteriae*, *Candida albicans*	Apu et al., 2013
Azadirachta indica	Leaf	Methanol	*Staphylococcus aureus*, *Escherichia coli*	Mishra et al., 2013
	Leaf	Chloroform, Hexane, methanol	*Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Aspergillus niger*, *Aspergillus fumigatus*, *Trichoderma viride*, *Cladosporium herbarum*, *Fusarium oxysporum*	Verma et al., 2013
	Leaf, bark, seed	Distilled water	*Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Enterococcus faecalis*, *Aspergillus fumigatus*, *Candida albicans*	Reddy et al., 2013
	Leaf, stem and root	Hot water and ethanol	*Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus vulgaris*, *Bacillus subtilis*	Sharma et al., 2011
	Seed	Volatile oil	*Staphyllococcus aureus*, *Escherichia coli*	Sandanasamy et al., 2013
	Flower	Volatile oil	*Bacillus subtillis*, *Candida albicans*, *Microsporum gypsum*	Aromdee et al., 2005

Box 2 (*Continued*)

Plant name	Part used	Extract	Microbes used	Reference
Cabralea canjerana	Leaves	Methanol	*Staphylococcus aureus, Escherichia coli, Candida albicans*	Moreno et al., 2004
Cedrela odorata	Leaves	Ethanol, chloroform	*Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Bacillius subtilis, Aspergillus niger, Penicillium notatum, Mucor mucedo, Candida albicans*	Idu et al., 2013
	Bark	Volatile oil	*Bacillus cereus, Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, Candida albicans, Aspergillus niger*	Villanueva et al., 2009
Cedrela serrata	Leaf and bark	Methanol	*Staphylococcus aureus, Bacillus subtilis, Proteus mirabilis, Salmonella typhi, Escherichia coli, Citrobacter* spp.	Ahmad et al., 2013
Chukrasia tabularis	Whole plant	Methanol	*Escherichia coli*	Rahman et al., 2008
Entandrophragma angolense	Seed	Volatile oil	*Salmonella gallinallum, Klebseilla pneumonia*	Orishadipe et al., 2012
Guarea macrophylla	Leaves	Methanol	*Staphylococcus aureus* subsp. *Aureus, Escherichia coli, Candida albicans*	Moreno et al., 2004
Khaya senegalensis	Stem bark	Methanol, ethanol, water, chloroform, pet ether	*Escherichia coli, Salmonella typhi*	Adebayo and Osman, 2012
Melia azedarach	Leaves, flowers and fruit-seed	Methanol	*Pseudomonas syringae* pv. *syringae, Xanthomonas campestris* pv. *campestris, Rathayibacter tritici, Escherichia coli*	Neycee et al., 2012
	Leaf	Methanol, ethanol, petroleum ether and water	*Bacillus cereus, Staphylocous aureus, Escherichia coli, Pseudomonas aeruginosa, Aspergillus niger, Aspergillus flavus, Fusarium oxisporum, Rhizopus stolonifer*	Sen and Batra, 2012
	Leaves	Petrol, benzene, ethyl acetate, methanol, aqueous	*Staphylococcus aureus, Staphylococcus epidermidis, Enterococcus faecalis, Bacillus subtilis, Escherichia coli, Edwardsiella tarda, Klebsiella pneumonia, Proteus mirabilis, P. vulgaris, Pseudomonas aeruginosa, Salmonella typhi, Shigella boydii, Shigella dysenteriae, Shigella flexneri, Plesiomonas shigelloides.*	Khan et al., 2011
Melia dubia	Bark	Petroleum ether, ethyl acetate, ethanol and water	*Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Candida albicans, Aspergillus flavus*	Cinu and Sarma, 1999
Munronia pumila	Stem	Hexane, dichloromethane, methanol	*Saccharomyces cerevisiae, Escherichia coli, Micrococcus luteus, Bacillus subtilis, Bacillus cereus*	Jayasinghe et al., 2002
Naragamia alata	Leaf, stem and root	Hot water and ethanol	*Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Proteus vulgaris, Bacillus subtilis*	Sharma et al., 2011
Sandoricum indicum	Root	Distilled water, ethanol	*Streptococcus pyogenes* NPRC 101	Limsuwan and Voravuthikunchai, 2013
Soymida febrifuga	Leaf	Butanol	*Bacillus subtillis, Escherichia coli, Klebsiella pneumonia, Proteus vulgaris, Staphylococcus aureus*	Riazunnisa et al., 2013
Swietenia macrophylla	Seed	Volatile oil	*Staphylococcus aureus, Salmonella typhimurium, Pseudomonas aeruginosa*	Suliman et al., 2013
Swietenia mahagoni	Leaf	Ether, chloroform, ethanol and water	*Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Bacillus subtilis, Candida albicans, Aspergillus flavus, Aspergillus niger, Trichophyton mentagrophytes*	Ayyappadhas et al., 2012
	Wood	Hexane	*Aspergillus flavus, A. niger*	Malairajan et al., 2012
	Leaf, stem and root	Hot water and ethanol	*Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Proteus vulgaris, Bacillus subtilis*	Sharma et al., 2011
	Leaf	Methanol	*Staphylococcus aureus, Bacillus subtilis, Escherichiae coli, Proteus vulgaris, Klebsiella pneumoniae, Pseudomonas aeruginosa, Proteus mirabilis, Aspergillus fumigatus, Candida albicans*	Chiranjib et al., 2011
Toona ciliata	Aerial parts	Ethanol	*Staphylococcus aureus*	Yan-Jiao et al., 2013
	Leaf flower	Petroleum ether, chloroform, ethyl acetate and methanol	*Staphylococcus aureus, Staphylococcus epidermidis, Klebsiella pneumonia, Proteus mirabilis, Pseudomonas aeruginosa, Salmonella typhimurium, Erwinia carotovora, Xanthomonas axonopodis* pv. *malvacearum, Xanthomonas campestris* pv. *vesicatoria, Xanthomonasoryzae* pv. *oryzae, Candida albicans, Microsporum canis*	Kavitha and Satish, 2013
	Heartwood	Hexane	*Staphylococcus aureus, Staphylococcus epidermitis, Bacillus cereus, Micrococcus luteus, Candida albicans, Aspergillus niger*	Malairajan et al., 2012
Toona sinensis	Leaves	Essential oil	*Bacillus subtilis, Escherichia coli, Pencillium citrinum, Colletotrichum gloeosporioides*	Jie et al., 2008; Chen et al., 2014
Trichilia clausseni	Bark	Methanol	*Alternaria alternata*	Carvalho et al., 2011
Trichilia hirta	Bark	Methanol	*Alternaria alternate*	Carvalho et al., 2011

Box 2 (*Continued*)

Plant name	Part used	Extract	Microbes used	Reference
Trichilia lepidota	Leaves	Methanol		Moreno et al., 2004
Walsura robusta	Leaf and branch	Distilled water and butanol	*Streptococcus pyogenes* NPRC 101	Limsuwan and Voravuthikunchai, 2013
Walsura trifoliata	Bark	Methanol, distilled water, petroleum ether, benzene	*Bacillus subtilis, B. licheniformis, B. coagulans, B. cereus, Staphylococcus aureus, S. epidermis, S. griséus, Escherichia coli, Proteus vulgaris, Pseudomonas flourescence, Aspergillus niger, A. flavus, Candida albicans, Pencillium chrysogenum*	Murthy and Nagamani, 2008
Xylocarpus granatum	Pericarp, seed	Distilled water, ethanol	*Streptococcus pyogenes* NPRC 101	Limsuwan and Voravuthikunchai, 2013
	Bark	Methanol	*Bacillus subtilis, Staphylococcus aureus, Proteus vulgaris*	Shahid-Ud-Daula and Basher, 2009
	Leaf, cuticle, stem	Methanol, hexane	*Vibrio alginolyticus, Edwardsiella tarda*	Choudhury et al., 2005
Xylocarpus mekongensis	Bark	Methanol, ethyl acetate, chloroform	*Staphylococcus aureas, Vibrio cholera, Shigella boydii, Shigella flexneri, Salmonella typhi, S. paratyphi*	Arif et al., 2013
	Leaf stem	Methanol, chloroform	*Staphylococcus aureus, Pseudomonas putida, Escherchia coli, Bacillus polymyxa, Klebsiella* sp., *Aspergillus fumigatus, A. niger*	Sahoo et al., 2013

antibacterial activity. Another interesting feature reported was inhibitory action of seed and leaf extracts of *Azadirachta indica* on fungi such as *Candida albicans*, *C. tropicalis*, *Neisseria gonorrhoeae* and the multi drug resistant *Staphylococcus aureus* (Talwar et al., 1997). Jayasinghe et al. (2002) screened Srilankan Meliaceae plants for antibacterial and antifungal activity.

Triterpenoids are an important group of constitutive defense substances present at sufficient concentrations to ward off potential plant pathogenic fungi (Grayer and Harborne, 1994). Triterpenoids from the family Meliaceae, in particular, are highly diversified in structure and have been extensively studied for their insect antifeedant and growth regulating activities (Champagne et al., 1992). Extracts from seeds of the neem tree *Azadirachta indica* containing triterpenoidal compounds are known to be effective against plant pathogenic fungi (Khan et al., 1974; Singh et al., 1980; Locke, 1995; Coventry and Allan, 1996; Govindachari et al., 1998; Steinhauer, 1999). Antifungal triterpenoids of the Meliaceae include four meliacins from *Chisocheton paniculatus* (Bordoloi et al., 1993) and nimonol and isomeldenin from *Azadirachta indica* (Suresh et al., 1997).

A number of limonoids have been reported from the genus *Swietenia* with structures assigned on the basis of spectral data (Kadota et al., 1990). Seven limonoids from methanolic extract of the seeds of *Swietenia mahogani* were isolated by Govindachari et al. (1999b). Triterpenoids (B,D-seco limonoids) from *S. mahogani* and *Khaya senegalensis* were evaluated for their antifungal activities (Govindachari et al., 1999b). Methyl angolensate and luteolin-7-*O*-glucoside obtained from ethyl acetate extracts of *Soymida febrifuga* root callus had an antibacterial effect against *Bacillus subtilis* and *Salmonella typhimurium*, respectively. In addition to that methyl angolensate had an anti-fungal activity against *Aspergillus niger* while luteolin-7-*O*-glucoside inhibited *Alternaria alternata* (Chiruvella et al., 2007).

Conclusion

Here we compiled the phytochemical and antimicrobial studies in taxa belong to the most important medicinal family Meliaceae, which might be effective in controlling infectious diseases. Nonetheless, the effectiveness of these phytochemicals needs to be validated *in vivo* for further investigation. Among the Meliaceae members, the genus *Aglaia*, *Azadirachta*, *Dysoxylum*, *Swietenia*, *Trichilia* have been more explored for the phytochemical screening where as *Azadirachta*, *Swietenia*, *Trichilia* have been more explored for their antimicrobial properties. Our critical analysis of published research data shows that most of the antimicrobial screening was carried out using plant crude extracts which is not much useful for further drug development. As these extracts contain many compounds along with the active compounds may cause side or toxic effects. Hence future research should be focused on the isolation and identification of active compounds with antimicrobial activity rather than simply screening the plant crude extracts. In addition research should take in depth studies to know the mechanism of action of drug so that it is beneficial for drug discovery and development. This review stands as a readymade map for phytochemical constituents and antimicrobial activities of Meliaceae family for the future researchers dealing with Meliaceae members.

Author contributions

VP, KKC, AM drafted the text, structures and charts, KKC, AM, GRG made all the alignments, corrections and proof reading to the script, CT helped in tabulating and reference management. All authors contributed to analysis and interpretation if data for the review. All authors participated in revising the article.

Conflicts of interest

The authors declare no conflicts of interest.

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