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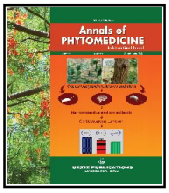

Review Article : Open Access

Review on chemical constituents of Bauhinia species

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Abstract

The genus *Bauhinia* which belongs to the subfamily, Caesalpinioideae of the main family Leguminosae, consists about 300 species of which 9 species occur in India. Majority of Bauhinia species are unarmed erect trees, or climbing shrubs with circinate tendrils. Several members of this genus are extensively used in indigenous medicine, in the treatment of the skin diseases, throat troubles, diarrhea, ulcers, dyspepsia, piles, leprosy, asthma, wounds, tumours, snake-bite, vermifuge, antipyretic and dysentric. This review of literature including phytochemical investigations on naturally occurring compounds of flavonoids, like flavones, flavonols, dihydroflavones, dihydroflavonols, chalcones, dihydrochalcones, flavans and catechins, stilbenes, stereoids, terpenes, fatty acids, alcohols and ester derivatives, lignans and miscellaneous chemical constituents from Bauhinia species.

1. Introduction

Bauhinia is a large genus of flowering plants which in the subfamily, Caesalpinioideae of the main family Leguminosae consists about 300 species of which 9 species occur in India (Gamble *et al*., 1956). Majority of *Bauhinia* species are unarmed erect trees, or climbing shrubs with circinate tendrils. Several members of this genus are extensively used in indigenous medicine (Kitikar*et al*., 1935;The Wealth of India, 1976; Mathew *et al*., 1983; Chopra *et al*., 1956), in the treatment of the skin diseases, throat troubles, diarrhea, ulcers, dyspepsia, piles, leprosy, asthma, wounds, tumours, snake-bite, vermifuge, antipyretic and dysentric.

A survey of the previous phytochemical studies on the genus *Bauhinia* showed that only a few species of a total of more than 300 have so far beenchemically investigated. The major chemical constituents so far reported from *Bauhinia* species include flavonoids, stilbenes and stilbene derived tri-and tetracyclic terpenes, fatty acid esters, lignans *etc*.

2. Flavonoid constituents of *Bauhinia* species

The flavonoid constituent so far isolated from the genus *Bauhinia* can be conveniently grouped into the following types:

(i) Flavones (Table 1)

(ii) Flavonols (Table 2)

(iii) Dihydroflavones and dihydroflavonols (Table 3)

(iv) Chalcones and dihydrochalcones (Table 4)

(v) Flavans and catechins (Table 5)

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Table 1: Flavones from different *Bauhinia* species

Compound	Plant source	Reference
1. Chrysin (**1**)	*B. purpurea*	Kuo *et al*., 1998
2. 6,8-dimethylchrysin (**2**)	*B. purpurea*	Kuo *et al*., 1998
3. Apigenin (**3**)	*B.variegata*	Wahab *et al*., 1987
4. Apigenin 7-*O*-β-D-glucopyranoside (**4**)	*B.variegata*	Wahab *et al*., 1987
5. Luteolin 5,3'-dimethylether (**5**)	*B.manca*	Achenbach *et al*., 1988
6. Luteolin 4'-*O*-*β*-D-glucopyranoside (**6**)	*B.tarapotensis*	Braca *et al*., 2001
7. Chrysoeriol (**7**)	*B.manca*	Achenbach *et al*., 1988
8. 5,7,3',4'-Tetramethoxyflavone (**8**)	*B.championii*	Chin *et al*., 1984 and 1994
9. 5,7,3',4',5'-Pentametxyflavone (**9**)	*B.championii*	Chin *et al*., 1984 and 1994
10. 5,6,7,3',4'-Pentametxyflavone (**10**)	*B.championii*	Chin *et al*., 1984 and 1994
11. 5,6,7,3',4',5'-Hexamet-hoxyflavone (**11**)	*B.championii*	Chin *et al*., 1984 and 1994
12. 5,6,7,5'-Tetramethoxy-3',4'-methylenedioxy-flavone (**12**)	*B.championii*	Chin *et al*.,1984 and 1994
13. 5,7,5'-Trimethoxy-3',4'-methylenedioxy flavone (**13**)	*B.championii*	Chin *et al*.,1984 and 1994
14. 7-Methoxy-5,6,3',4'-dimethylenedioxyflavone (Bausplendin) (**14**)	*B.splendens*	Laux *et al*.,1985
15. 5,6-Dihydroxy-7-methoxyflavone-6-*O*-*β*-D-xylopyranoside (**15**)	*B.purpurea*	Yadava *et al*.,2000

Bausplendin (**14**), a flavone reported from *B.splendens* (Laux *et al*., 1985), with methylenedioxy substitution in ring-A and ring-B is a rare feature among flavones. C-alkylation among flavones is rare and the isolation of 6,8-dimethylchrysin (**2**) from *B. purpurea* (Kuo *et al*.,1998) constitutes the only of an alkyl substituted flavone from this genus. Different substituted flavones (**1-15**) isolated from *Bauhinia* species are mentioned in Figure 1 and Table 1.

From Table 2, it is evident that all the flavonol glycosides reported from *Bauhinia* species are either kaempferol or quercetin derivatives with the sugar residue attached to the 3-position in the majority of the glycosides. 6,4'-Dihydro-3'-prenyl-3,5,7,5'-tetramethoxy flavone-6-*O*-*α*-L-rhamnopyranoside (**26**), a flavonol glycoside isolated from *B.purpurea* (Yadava *et al*., 2001) is the only prenylatedflavonol glycoside occurring in *Bauhinia* species mentioned in Figure 2 and Table 2.

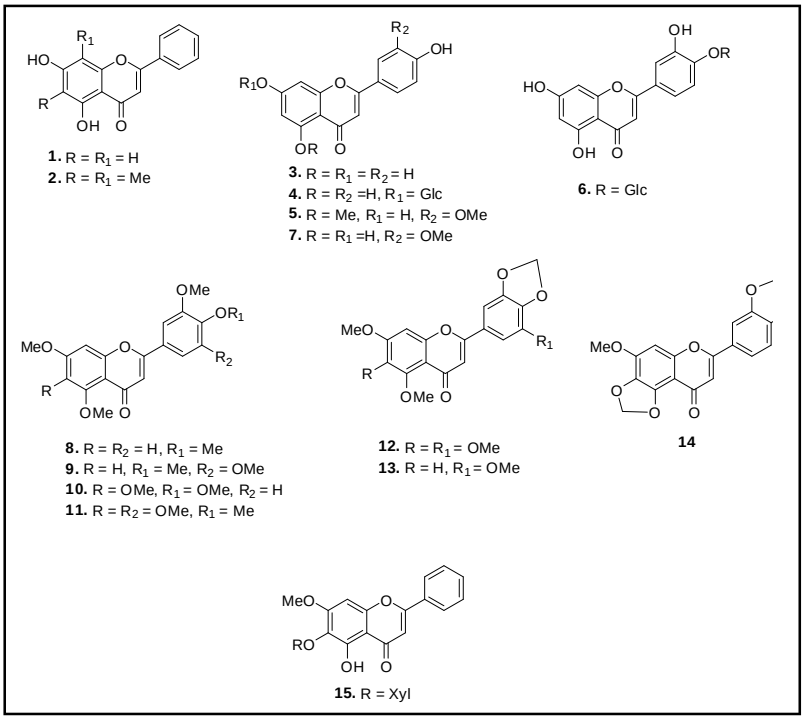


Figure 1: Flavones (1-15).

Table 2: Flavonols isolated from various *Bauhinia* species

Compound	Plant source	Reference
1. Kaempferol (16)	*B.manca, B.vahlii, B. purpurea*	Achenbach *et al*., 1988; Sultana *et al*., 1985; Kuo *et al*., 1997
2. Kaempferol 3-O-β-D-glucopyranoside (17)	*B.purpurea, B.variegata,*	Ramachandran *et al*., 1967; Gupta *et al*., 1984;
3. Kaempferol 3-O-β-D-galactoside (18)	*B.variegata*	Rahman *et al*., 1985
4. Kaempferol 3-O-α-L-rhamnopyranoside (19)	*B.uruguagensis*	Iribarren *et al*., 1989
5. Kaempferol 3-O-β-D-rutinoside (20)	*B.variegata, B.candicans, B.tomentosa, B.retusa*	Wahab *et al*., 1987; Rahman *et al*., 1985; Iribarren *et al*., 1983; Row *et al*., 1954; Tiwari *et al*., 1978
6. Kaempferol 3-O-β-D-rutinoside-7-O-α-L -rhamnopyranoside (21)	*B.candicans*	Iribarren *et al*., 1983
7. Quercetin (22)	*B.variegata, B.vahlii, B.purpurea, B.tomentosa*	Wahab *et al*., 1987; Sultana *et al*., 1985; Wahab *et al*., 1987; Ramachandran *et al*., 1967; Row *et al*., 1954; Subramanian *et al*., 1963
8. Quercetin-3-methyl ether (23)	*B.purpurea*	Kuo *et al*., 1997
9. Quercetin-3-O-β-D-glucopyranoside (Isoquercetrin) (24)	*B.vahlii, B.purpurea, B.retusa, B.tomentosa*	Sultana *et al*., 1985; Ramachandran *et al*., 1967; Tiwari *et al*., 1978; Subramanian *et al*., 1963
10. Quercetin-3-O-α-L-rhamnopyranoside (Quercetrin) (25)	*B.variegata, B.uruguagensis*	Wahab *et al*., 1987; Iribarren *et al*., 1989
11. 6,4'-Dihydro-3'-prenyl-3,5,7,5'-tetrameth-oxyflavone-6-O-α-L-rhamnopyranoside(26)	*B.purpurea*	Yadava *et al*., 2001

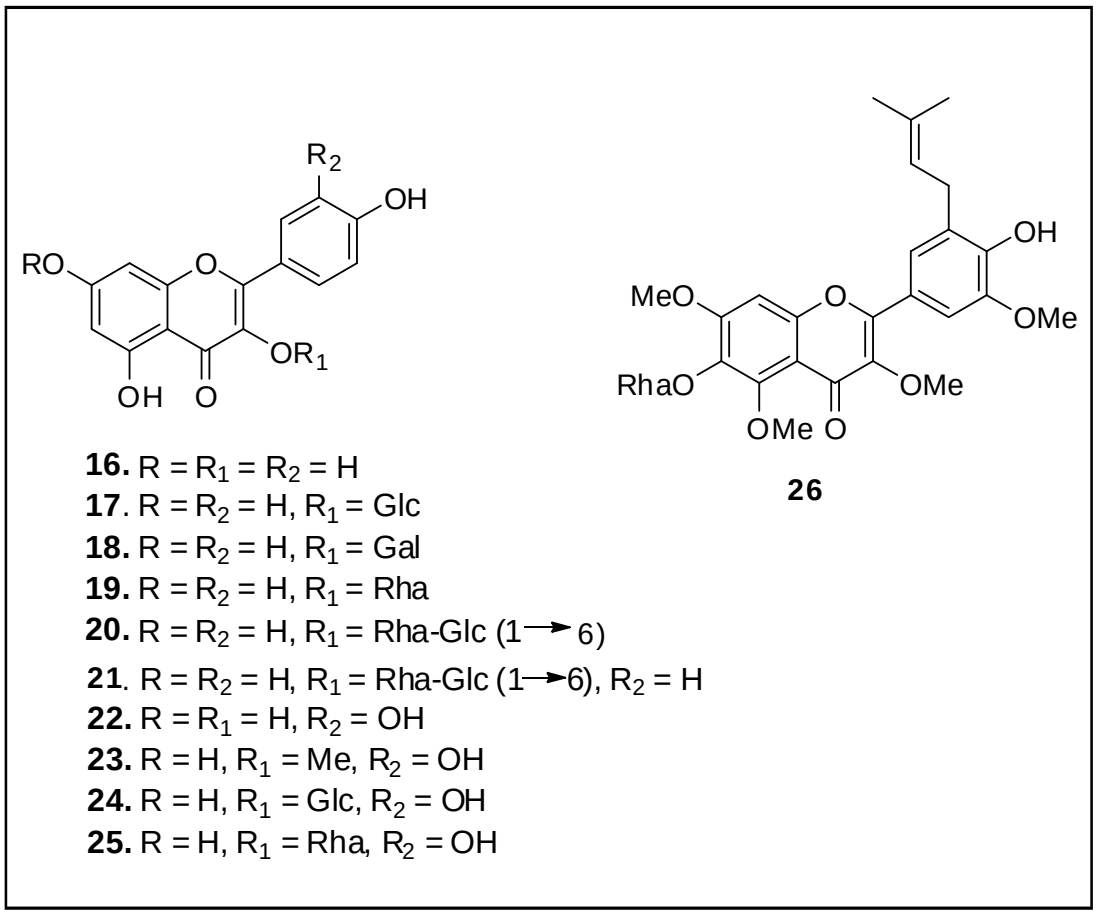


Figure 2: Flavonols and its derivatives (16-26).

Table 3: Dihydroflavones and dihydroflavonols reported from *Bauhinia* species

Compound	Plant source	Reference
1. Naringenin (27)	*B.manca*	Achenbach *et al*., 1988
2. Eriodictyol (28)	*B.manca*	Achenbach *et al*., 1988
3. Liquiritigenin (29)	*B.manca*	Achenbach *et al*., 1988
4. Liquiritigenin-7-methyl ether (30)	*B.manca*	Achenbach *et al*., 1988
5. Liquiritigenin-4'-methyl ether (31)	*B.manca*	Achenbach *et al*., 1988
6. 5,7,4'-Trihydroxyflavanone-4'-*O*-*α*-L-rhamnopyranosyl-*β*-D-glucopyranoside (32)	*B.variegata*	Gupta *et al*., 1979
7. 4'-Hydroxy-5,7-dimethoxyflavanone-4'-*O*-*α*-L-rhamnopyranosyl-*β*-D-glucopyranoside (33)	*B.variegata*	Gupta *et al*., 1980
8. Strobopinin (34)	*B.championii*	Chin *et al*., 1994
9. Taxifolin (35)	*B.hupenhara, B.purpurea*	Xiangui *et al*., 1992; Kuo *et al*., 1997
10. 6-(3''-Oxobutyl)taxifolin (36)	*B.purpurea*	Kuo *et al*., 1998

The compounds **29**-**31**, occurring in *B.manca* (Achenbach *et al*., 1988) constitutes the first report of 5-deoxyflavanones from this genus. Strobopinin (**34**), a methylflavanone occurring in *B.championii* (Chin *et al*., 1994) is the only C-alkyl substituted flavanone reported from *Bauhinia* species. 6-(3''-Oxobutyl) taxifolin (**36**) reported from *B.purpurea* (Kuo *et al*., 1998), is a novel dihydroflavanol with a rare oxobutyl residue at 6-position.Different dihydroflavones and dihydroflavonols reported from *Bauhinia* species are mentioned in Figure 3 and Table 3.

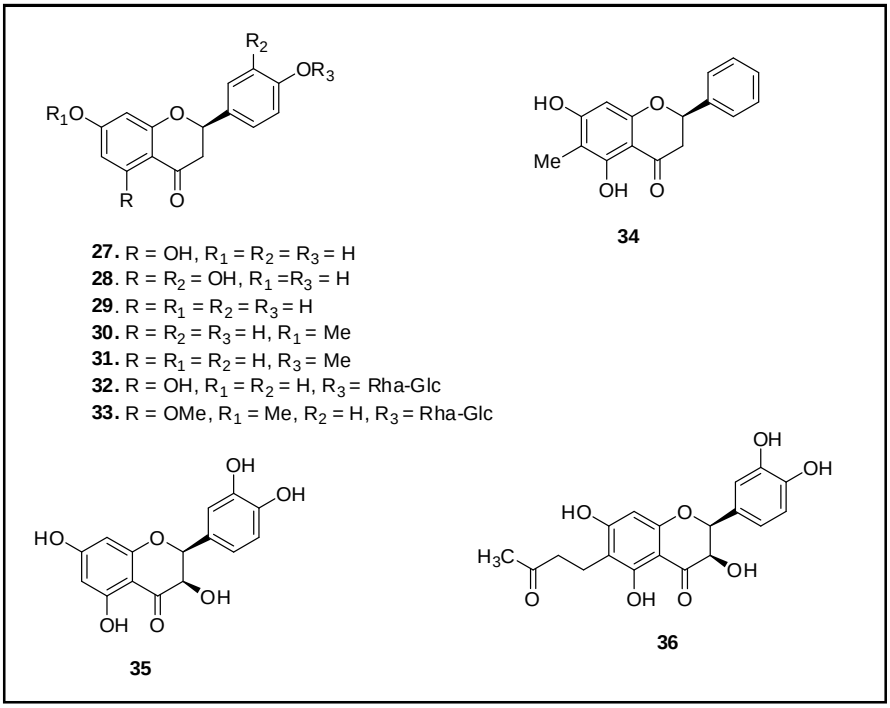


Figure 3: Dihydroflavones and dihydroflavonols derivatives (27-36).

Table 4: Chalcones and dihydrochalcones isolated from various *Bauhinia* species

Compound	Plant source	Reference
1. Isoliquiritigenin (**37**)	*B.manca*	Achenbach *et al.*, 1988
2. Isoliquiritigenin-2'-methyl ether (**38**)	*B.manca*	Achenbach *et al.*, 1988
3. Isoliquiritigenin-4-methyl ether (**39**)	*B.manca*	Achenbach *et al.*, 1988; Chin *et al.*, 1994
4. Echinatin (**40**)	*B.manca*	Achenbach *et al.*, 1988
5. 3,4-Dihydroxychalcone-4-*O*-*β*-L-arabino-pyranosyl-galac topyranoside (**41**)	*B.purpurea*	Bhartia *et al.*, 1981
6. 3,4,2',4'-Tetrahydroxychalcone-4'-*O*-*β*-L- arabinopyranosyl -galactopyranoside (**42**)	*B.purpurea*	Bhartia *et al.*, 1979
7. 2,4'-Dihydroxy-4-methoxydihydrochalcone (**43**)	*B.manca*	Achenbach *et al.*, 1988

Compound **41** reported from *B.purpurea* (Bhartia *et al.*, 1981) is achalcone devoid of A-ring oxygenation and is a rare feature among naturally occurring chalconesand dihydrochalcones isolated from various *Bauhinia* species are mentioned in Table 4 and Figure 4.

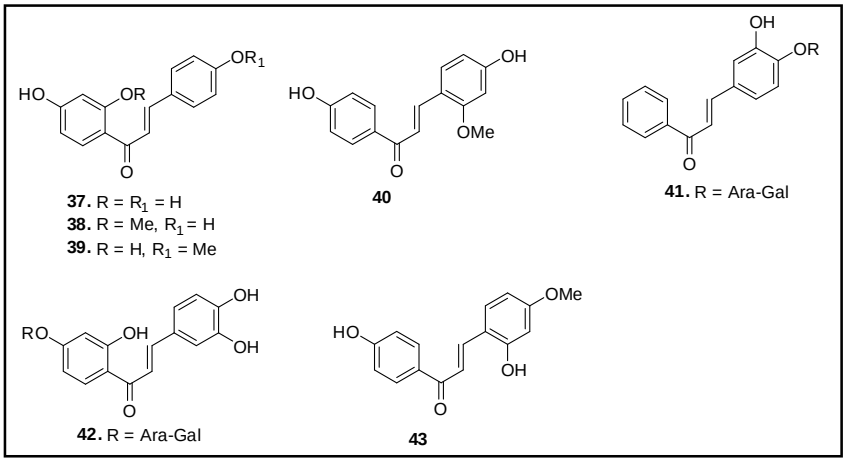


Figure 4: Chalcones and dihydrochalcones derivatives (37-43).

Table 5: Flavans and catechins reported from *Bauhinia* species

Compound	Plant source	Reference
1. 7,4'-Dihydroxyflavan (**44**)	*B. manca*	Achenbach *et al*., 1988
2. 7,3'-Dimethoxy-4'-hydroxyflavan (**45**)	*B. manca*	Achenbach *et al*., 1988
3. 4'-Hydroxy-7-methoxyflavan (**46**)	*B. manca*	Achenbach *et al*., 1988; Viana *et al*., 1999
4. 3',4'-Dihydroxy-7-methoxyflavan (**47**)	*B. manca*	Achenbach *et al*., 1988
5. 7,4'-Dihydroxy-3'-methoxyflavan (**48**)	*B. manca*	Achenbach *et al*., 1988
6. Catechin (**49**)	*B. championii*	Chin *et al*., 1994
7. 3-*O*-Galloylepicatchin (**50**)	*B. manca*	Achenbach *et al*., 1988

It is interesting to note that all the five flavan derivatives (**44-48**) occurring in the genus *Bauhinia* was reported from *B.manca* (Achenbach *et al*., 1988). The flavans, **45** and **47** reported from *B.manca* (Achenbach *et al*., 1988) showed significant antifungal activity. Flavans and catechinsderivatives arereported from *Bauhinia* species mentioned in Table 5 and Figure 5.

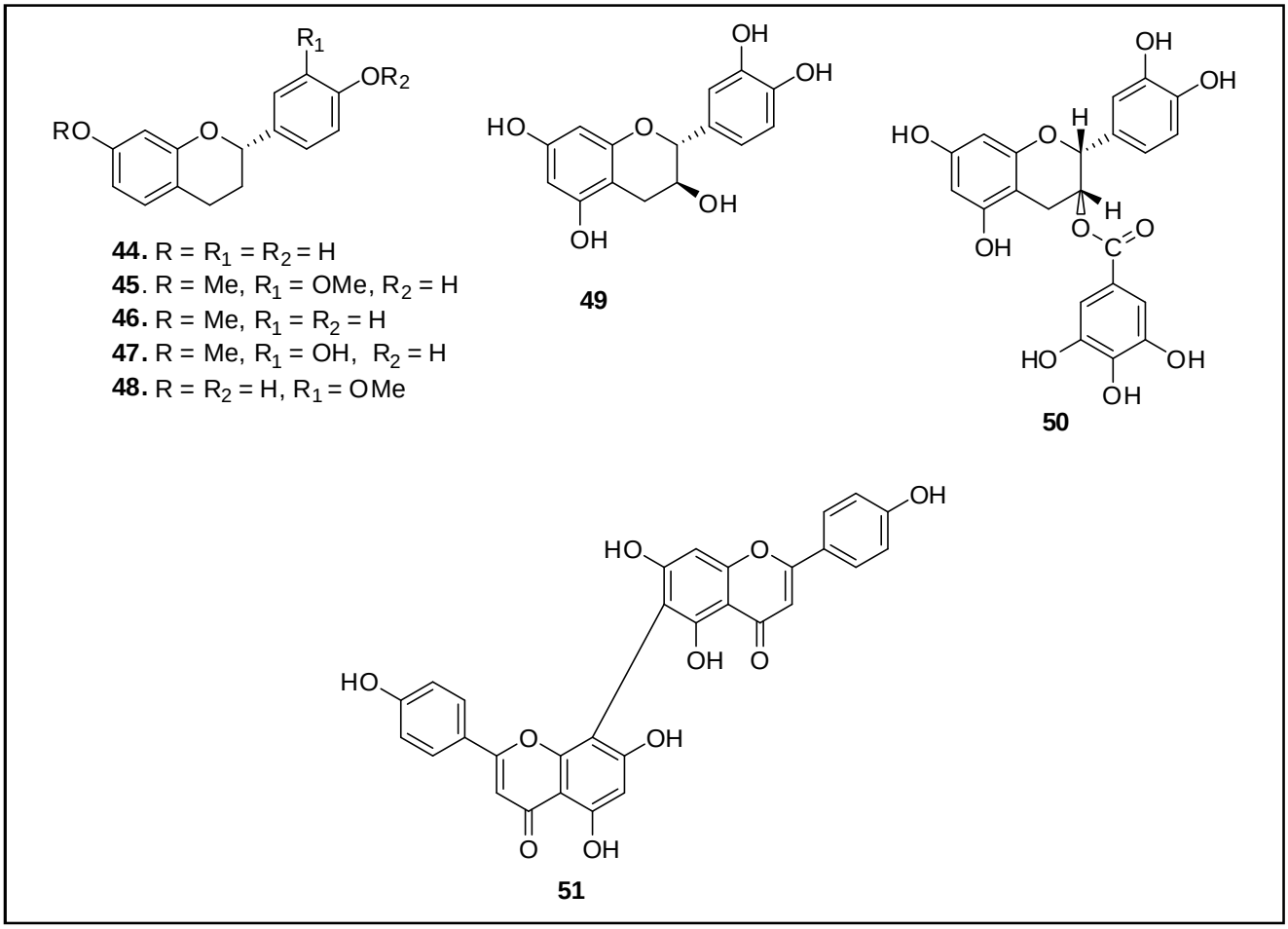


Figure 5: Flavans and catechins derivatives (44-51).

In addition to the flavonoid compounds listed in Tables 1-5, agathisflavone (**51**), a biflavone isolated from as hexamethyl ether from *B.vahlii* (Sultana *et al*., 1985) is the first report and the only report of biflavonoid in the genus *Bauhinia*. Resveratrol, a natural polyphenol potent antioxidant, antinflammatory agent obtained from stilbenes. *In vitro* studies of resveratrol shows decreased production of TNF-α, IL-1β in monocytes / macrophages (Paramitha *et al*., 2021)

3. Stilbenes and the stilbene derived tricyclic and tetracyclic phenols

The stilbene and stilbene derived tricyclic and tetracyclic phenolic compounds occurring in the genus *Bauhinia* are presented in Table 6 and Figure 6.

Table 6: Stilbenes and the stilbene derived phenolic compounds from *Bauhinia* species

Compound	Plant source	Reference
1. Resveratrol (**52**)	*B. racemosa*	Anjaneyulu *et al.*, 1984
2. Preracemosol A (**53**)	*B. malabarica*	Kittikoop *et al.*, 2000
3. Preracemosol B (**54**)	*B. malabarica*	Kittikoop *et al.*, 2000
4. Racemosol (**55**)	*B. racemosa, B.malabarica*	Anjaneyulu *et al.*, 1986; Kittikoop *et al.*, 2000
5. De-*O*-methylracemosol (**56**)	*B. rufescens, B.racemosa, B. malabarica*	Maillard *et al.*,1991; Prabhakar *et al.*, 1994; Kittikoop *et al.*, 2000
6. 3-Hydroxy-de-O-methylracemosol (**57**)	*B. racemosa*	Jain *et al.*, 2002
7. 1,7,8,12b-Tetrahydro-2,2,4-trimethyl-2*H*-benzo [6,7]cyclohepta[1,2,3-de]benzopyran-5,10,11-triol (**58**)	*B. rufescens*	Maillard *et al.,1991*
8. 5,6-Dihydro-11-methoxy-2,2,12-trimethyl-2*H*-naphtho [1,2,-*f*][1]benzopyran-8,9-diol (**59**)	*B.rufescens*	Maillard *et al.*,1991
9. 11-Methoxy-2,2,12-trimethyl-2*H*-naphtho[1,2,-*f*][1] benzopyran-8,9-diol (**60**)	*B.rufescens*	Maillard *et al.*,1991
10. 1,7-Dihydroxy-3-methoxy-2-methyl-dibenzo[b,f]oxepin (Pacharin) (**61**)	*B.racemosa*	Anjaneyulu *et al.*, 1984

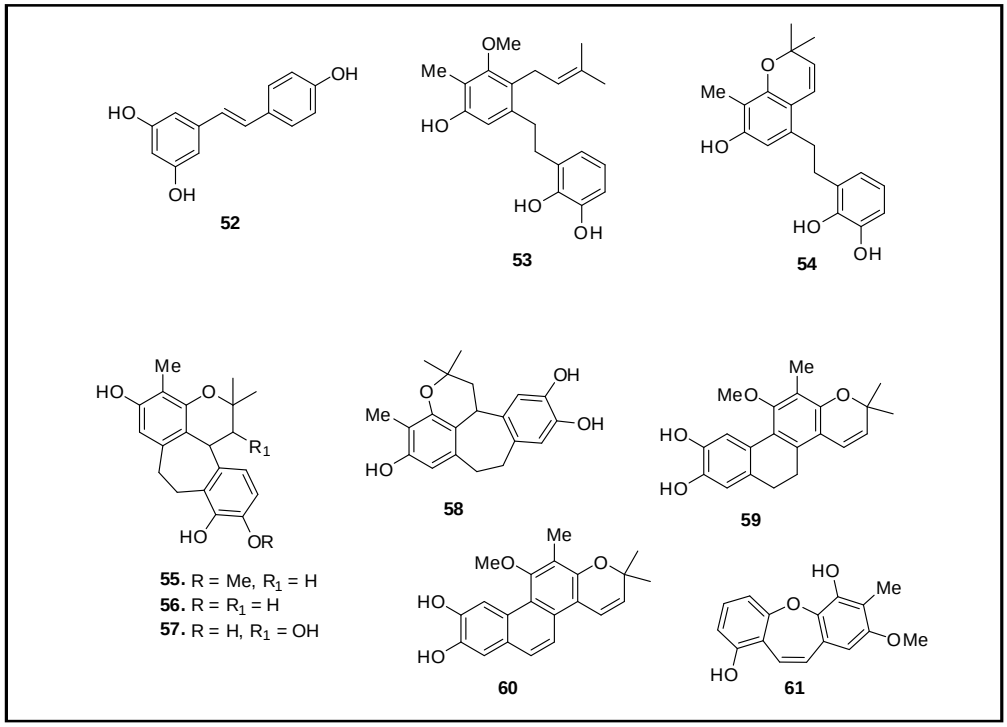
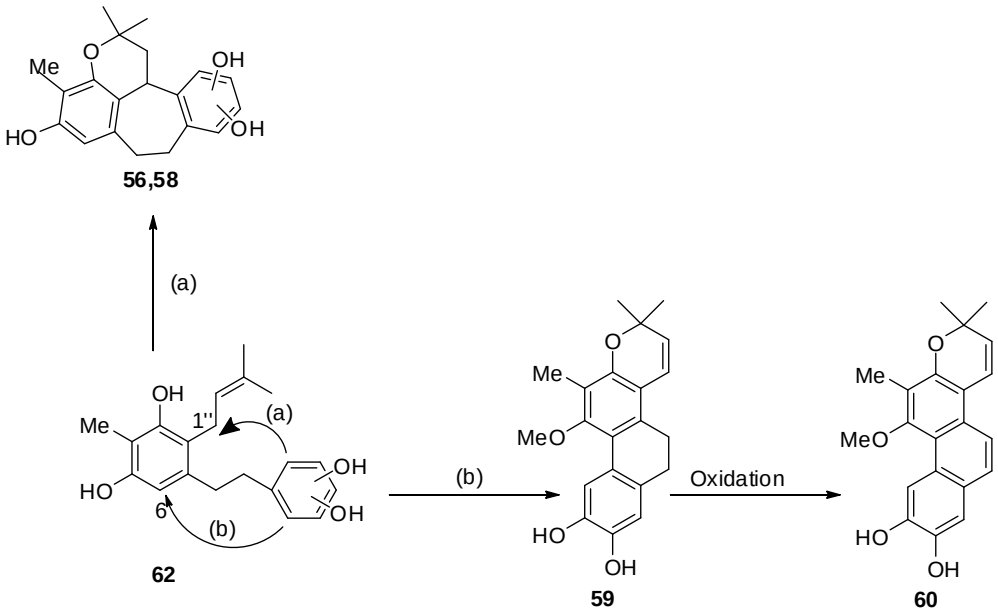


Figure 6: Stilbenes and the stilbene derived phenolic compounds (52-61).

The occurrence of preracemosol A (**53**) and preracemosol B (**54**) from *B.malabarica* (Kittikoop *et al.*, 2000) constitute the first report of bibenzyl derivatives in this genus. These two bibenzyl derivatives exhibited moderate antimalarial activity. The isolation of racemosol (**55**) from *B.malabarica* (Anjaneyulu *et al.*, 1986) constitutes the first report of a new and novel tetracyclic phenolic compound from the genus *Bauhinia*.

Maillard *et al.* (1991) have postulated that the four new antifungal tetracyclic phenolic compounds (**56,58-60**) occurring in *B.rufescens* might have obtained biogeneticallyfrom a common stilbene precursor (**62**) (Scheme-I). Intramolecular cyclization of **62** to the chroman (or chromene) ring and oxidative cyclization at C-6 or C-1'' would lead to compounds **56**, **58** and **59** (Scheme 1). Compound **60** could be an oxidation product of **59**. The presence of preracemosol A (53) and preracemosol B (**54**) in *B.malabarica* (Kittikoop *et al.*, 2000) supported Maillard and coworkers's postulation that the stilbene derivative, **62** should be the common precursor for all the tetracyclic stilbene derivatives (**55-60**).



Scheme-I. Postulated Biosynthetic pathway for compounds **56, 58-60**

The isolation of pacharin (**61**) from *B.malabarica*by Anjaneyulu *et al*. (1984) constitutes the first report of a naturally occurring dibenzo[b,f] oxepin derivative. The structure of pacharin was established as 1,7-dihydroxy-3-methoxy-2-methyl-dibenzo [b,f]oxepin (**61**) by spectral and X-ray analysis as well as by synthesis (Comber *et al.*, 1980). Anjaneyulu *et al*. (1984) have postulated that pacharin (**61**) might have derived biogenetically from the corresponding stilbene derivative by ring closure. It is therefore significant to note the occurrence of resveratrol (**52**) in the same plant.

4. Steroids

The steroids occurring in the genus *Bauhinia* are presented in Table 7 and Figure 7.

Table 7: Steroids compounds isolated from various *Bauhinia* species

Compound	Plant source	Reference
1. Cheolesterol (**63**)	*B.candicans*	Iribarren *et al.*, 1983
2. Campesterol (**64**)	*B.candicans, B.vahlii*	Iribarren *et al.*, 1983; Sultana *et al.*, 1985
3. Stigmasterol (**65**)	*B.candicans, B.vahlii*	
	B.guianensis, B.purpurea	Iribarren *et al.*, 1983; Sultana *et al.*, 1985 Viana *et al.*, 1999; Kuo*et al.*, 1997
4. Stigmast-3,5-dien-7-one (**66**)	*B.candicans*	Iribarren *et al.*, 1983
5. 3β-Hdroxystigmast-5-en-7-one (**67**)	*B.purpurea*	Kuo *et al.*, 1997
6. 3-*O*-β-D-Glucopyranosyl-stigmast-5,22-diene (**68**)	*B.guianensis*	Viana *et al.*, 1999
7. β-Sitosterol (**69**)	*B.candicans, B.vahlii, B.racemosa, B.guianensis*	Iribarren *et al.*, 1983, Sultana *et al.*, 1985 Anjanneyulu *et al.*, 1984; Jain *et al.*, 2002; Bhartia *et al.*, 1981
8. Sitosterol-3-*O*-β-D-Glucopyranoside (**70**)	*B.candicans*	Iribarren *et al.*, 1983
9. Sitosterol-3-*O*-β-D-riburonofuranoside (**71**)	*B.guianensis*	Viana *et al.*, 1999
10. Sitosterol-3-*O*-β-D-Xylopyranoside (**72**)	*B.candicans*	Comber *et al.*, 1990
11. β-Sitosterylhexadecanote (**73**)	*B.candicans*	Iribarren *et al.*, 1984
12. β-Sitosteryloctadecanote (**74**)	*B.purpurea*	Kuo *et al.*, 1997
13. 6'-(β- Sitosteryl-3-*O*-β-Glucopyranosidyl) hexadecanoate (**75**)	*B.purpurea*	Kuo *et al.*, 1997
14. 6'-(β- Sitosteryl-3-*O*-β-Glucopyranosidyl) tetraeicosanoate (**76**)	*B.purpurea*	Kuo *et al.*, 1997

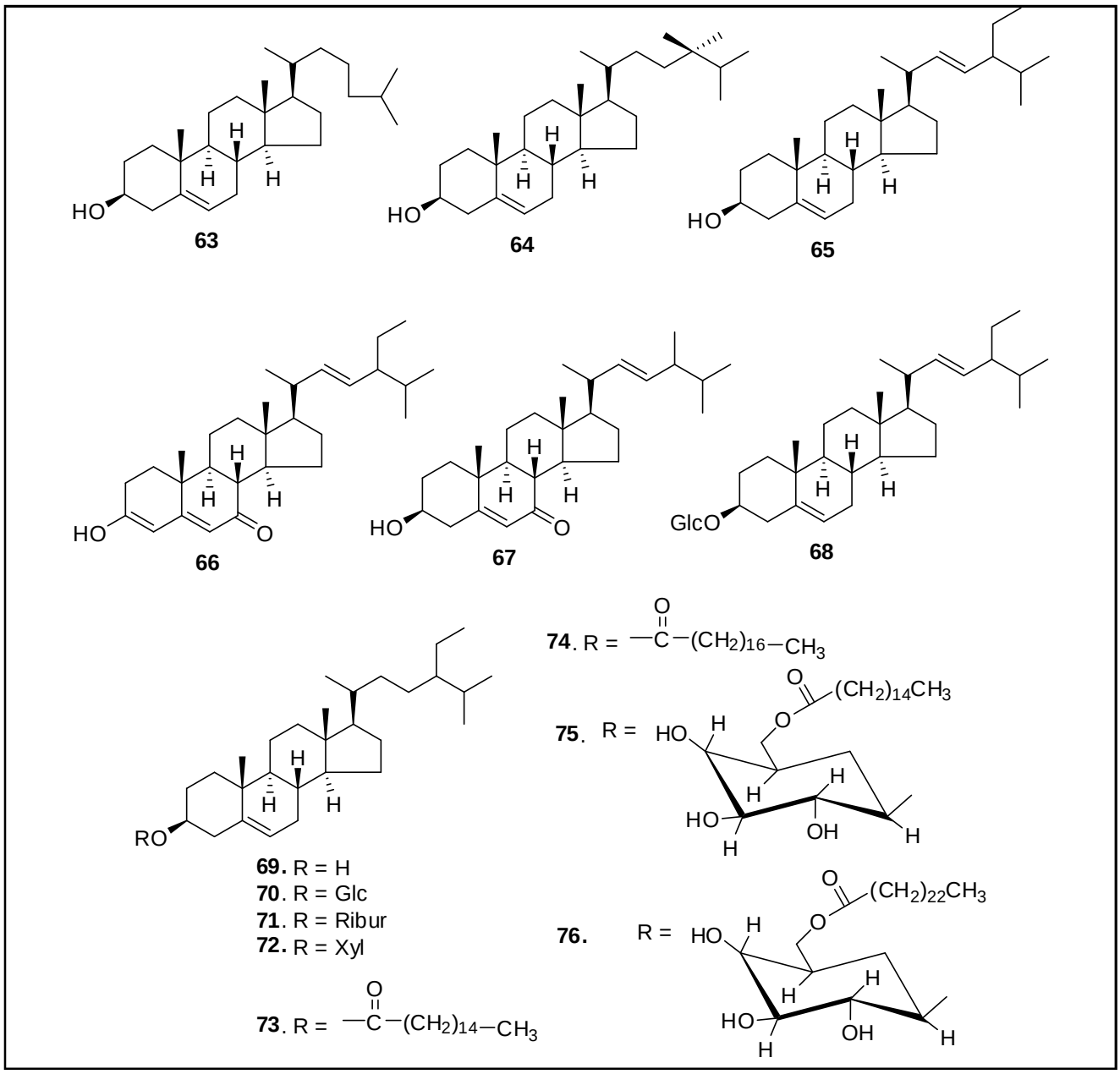


Figure 7: Steroids and its derivative (63-76).

5. Terpenes

All the terpenoid constituents reported from *Bauhinia* species belong to the triterpene class and are presented in Table 8 and Figure 8.

Table 8: Terpenes reported from various *Bauhinia* species

Compound	Plant source	Reference
1. β-Amyrin (**77**)	*B. racemosa*	Anjanneyulu *et al.*, 1984
2. Lupeol (**78**)	*B. racemosa*	Kuo *et al.*, 1997; Jain *et al.*, 2002
3. Lupenone (**79**)	*B. racemosa*	Kuo *et al.*, 1997
4. Betulin (**80**)	*B. racemosa*	Jain *et al.*, 2002
5. Betulinic acid (**81**)	*B. vahlii*	Sultana *et al.*, 1985

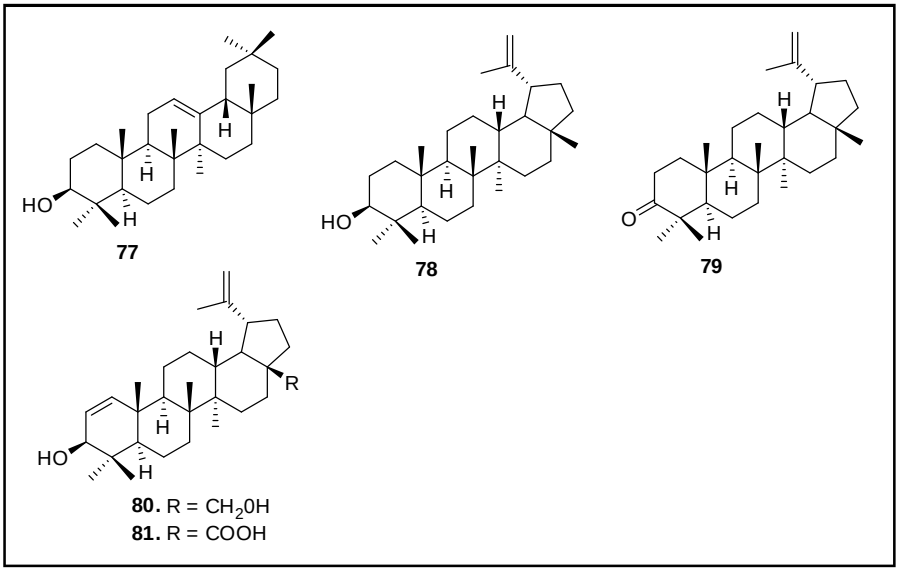


Figure 8: Triterpenoids and its derivatives (77-81).

6. Fatty acids, alcohols and ester derivatives

Bauhinia purpurea is the only species which is reported to fatty acids, alcohols and ester derivatives and these are listed in Table 9 and Figure 9.

Table9: Fatty acids, alcohols and ester derivatives reported from *Bauhinia* species

Compound	Plant source	Reference
1. Hexadecanoic acid (**82**)	*B. purpurea*	Kuo *et al.*, 1997
2. 1-Tetracosonol (**83**)	*B. purpurea*	Kuo *et al.*, 1997
3. 1-Hexacosonol (**84**)	*B. purpurea*	Kuo *et al.*, 1997
4. 1-Octacosonol (**85**)	*B. purpurea*	Kuo *et al.*, 1997
5. Glycerol (**86**)	*B. purpurea*	Kuo *et al.*, 1997
6. 2,3-Dihydroxypropyl hexadecanoate (**87**)	*B. purpurea*	Kuo *et al.*, 1997
7. 2,3-Dihydroxypropyl octadecanoate (**88**)	*B. purpurea*	Kuo *et al.*, 1997
8. 2,3-Dihydroxypropyl oleate (**89**)	*B. purpurea*	Kuo *et al.*, 1998
9. 2,3-Dihydroxypropyl linoleate (**90**)	*B. purpurea*	Kuo *et al.*, 1998
10. Methyl hexadecanoate (**91**)	*B. purpurea*	Kuo *et al.*, 1997
11. Methyl octadecanoate (**92**)	*B. purpurea*	Kuo *et al.*, 1997
12. 3-(3,4-Dihydroxyphenyl)prop-2-enoyl ester of 2,3,4-trihydroxy-3-hydroxy-methylbutyric acid (**93**)	*B. tarapotensis*	Braca *et al.*, 2001

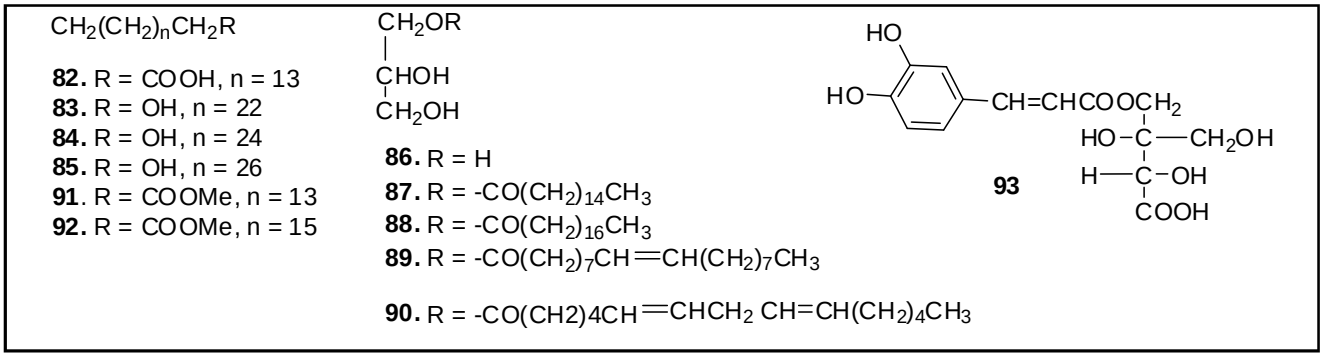


Figure 9: Fatty acids, alcohols and ester derivatives (82-93).

7. Lignans

The lignans reported from *Bauhinia* species are listed in Table 10 and Figure 10.

8. The miscellaneous chemical constituents isolated and reported from the *Bauhinia* species are presented in Table 11 and Figure 11.

The caffeoyl ester of apionic acid (**93**) and the cyclohexenone derivative (**97**) reported from *B.tarapotensis* showed significant antioxidant activity. Vijaya Bhaskar Reddy *et al.* (2003) reported a new dihydrodibenzoxepin derivative, namely; as 1,7-dihydroxy-3,4-dimethoxy-2-methyl-5,6-dihydroxyoxepin(b,f)oxepin (**110**) and a new flavanone, 5,7-dimethoxy-3,4-methylenedioxyflavanone (**111**) from *B.variegata*. The phytochemical screening of extracts of *Bauhinia purpurea* leaves, showed presence of flavonoids, glycosides, polyphenols, saponin and steroids. These were established preliminary by color tests (Susmita *et al.*, 2020). Evaluation of the in *vitro* antioxidant potential *Bauhinia variegate* plant extract using DPPH (2, 2-diphenyl-1-picrylhydrazyl) and nitric oxide scavenging methods along with phytochemical analysis through thin layer chromatography (Punit *et al.*, 2019).

Table 10: Lignans isolated from various *Bauhinia* species

Compound	Plant source	Reference
1. Syringaresinol (**94**)	*B.manca*	Achenbach *et al.*, 1988
2. (7*S*, 8*R*, 8'*R*)-5,5'-Dimethoxylariciresinol (**95**)	*B.manca*	Achenbach *et al.*, 1988
3. (+)-1-Hydroxypinoresinol-1-*O*-â-D-glucopyranoside (**96**)	*B.tarapotensis*	Braca *et al.*, 2001

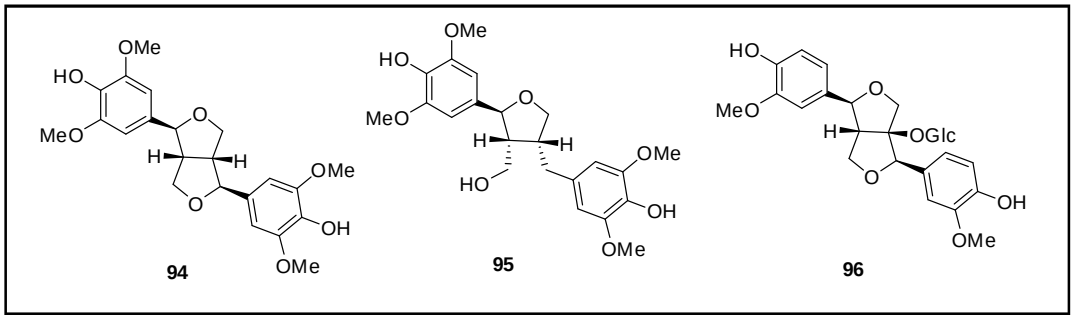


Figure 10: Fatty acids, alcohols and ester derivatives (94-96).

Table 11: Miscellaneous chemical constituents reported from *Bauhinia* species

Compound	Plant source	Reference
1. *Cis*-2,4-Dihydroxy-2(2-hydroxyethyl)cyclohex -5en-1-one (**97**)	*B.tarapotensis*	Braca *et al.*, 2001
2. Lapachol(**98**)	*B.guianensis*	Viana *et al.*, 1999
3. 5,7-Dihydroxychromone (**99**)	*B.purpurea*	Kuo *et al.*, 1997
4. Gallic acid (**100**)	*B.manca*	Achenbach *et al.*, 1988
	B.championii	Chen *et al.*, 1985
5. Vanillic acid (**101**)	*B.purpurea*	Kuo *et al.*, 1997
6. Isotachioside (**102**)	*B.purpurea*	Kuo *et al.*, 1997
7. (-) Isolariciresinol-3-á-*O*-â-D-glucopyranoside (**103**)	*B.tarapotensis*	Braca *et al.*, 2001
8. Isoaceteoside (**104**)	*B.tarapotensis*	Braca *et al.*, 2001
9. Indole-3-carboxylic acid (**105**)	*B.tarapotensis*	Braca *et al.*, 2001
10. D-Pinitol (**106**)	*B.candicans*	Iribarren *et al.*, 1983
11. Bornesitol (**107**)	*B.purpurea*	Kuo *et al.*, 1997
12. Bauhinin (**108**)	*B.championii*	Chen *et al.*, 1985
13. Ω-Hydroxypropioguaiacone (**109**)	*B.manca*	Achenbach *et al.*, 1988

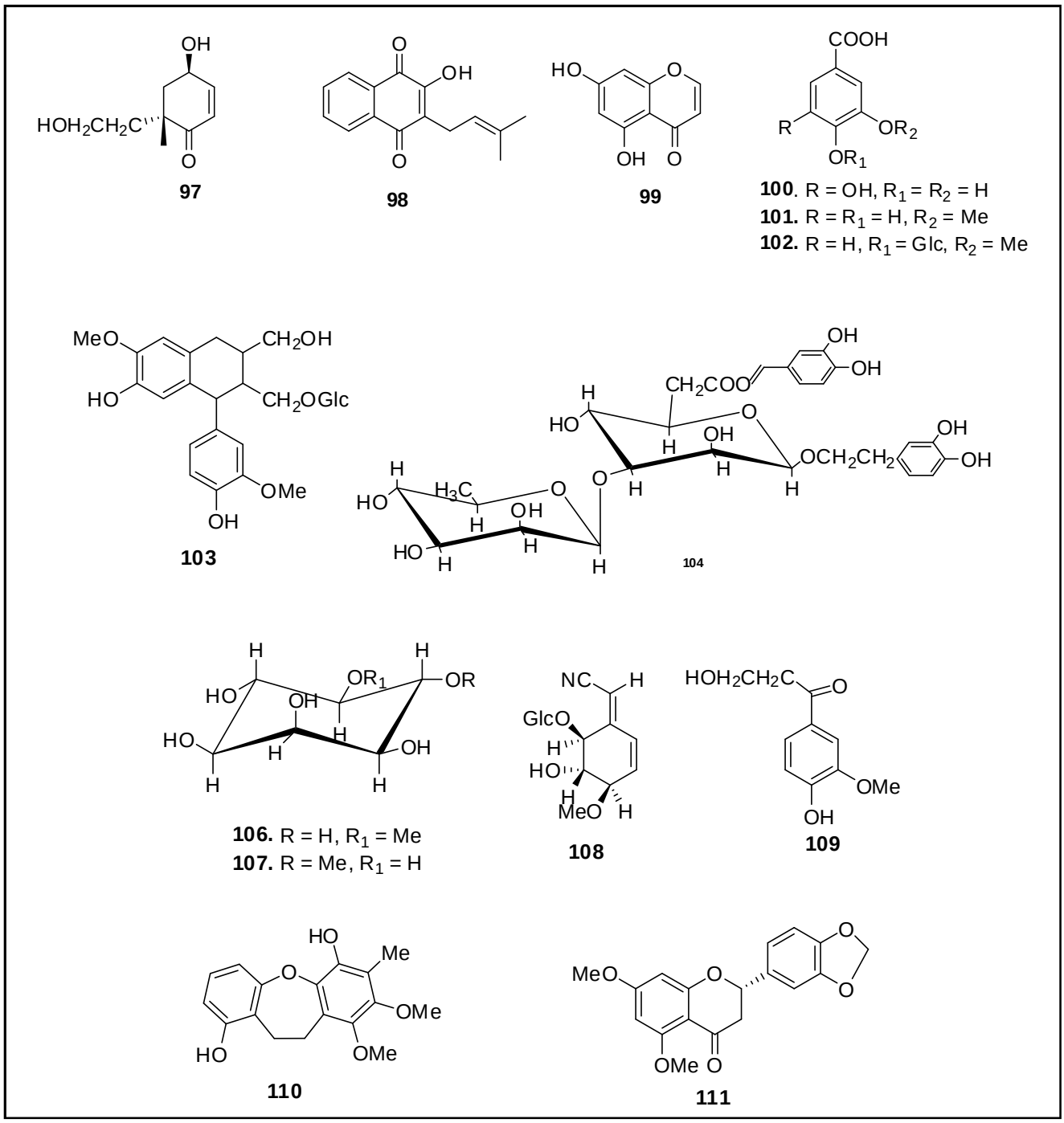


Figure 11: Miscellaneous chemical constituents (97-111).

9. Conclusion

This review of literature including phytochemical investigations on naturally occurring chemical compounds like flavones, flavonols, dihydroflavones, dihydroflavonols, chalcones, dihydrochalcones, flavans and catechins, stilbenes, stereoids, terpenes, fatty acids, alcohols and ester derivatives, lignans and miscellaneous chemical constituents reported from *Bauhinia* species will help researchers and scientists in locating the detailed information and address the continuous development in the phytochemistry and the therapeutic applications. Biosynthetic pathway of pacharin was established through the synthesis and X-ray analysis.

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Conflict of interest

The author declares no conflicts of interest relevant to this article.

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