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Review Article

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Ethnopharmacology, Phytochemistry, and Biological Properties of Medicinally Important Plants of Bignoniaceae Family: A Comprehensive Review

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Abstract: **Aim of the study:** The family Bignoniaceae is also known as the "trumpet vine family". Majority of members of this family scattered throughout tropical America. Traditionally, plants of this family were used to treat various disorders, like neuralgia and varicose veins, diabetes, syphilis, ulcers, abscesses, rheumatism, gonorrhoea, and wounds. The biological characteristics, phytochemistry, and chemotaxonomic classification of the phytochemicals of several species of the family Bignoniaceae are highlighted in this paper. **Materials and methods:** The relevant information on the family Bignoniaceae was obtained from scientific databases (Google Scholar, ACS Publications, Wiley Online Library, Science Direct, PubMed). Information was also gathered from books and online databases. The literature cited in this review dates from 1971 to June 2022. **Result:** About 133 compounds have been isolated from various species of the family Bignoniaceae, including anthraquinones, sterols, terpenoids, benzoquinone, naphthoquinones, phthalide derivative, furanonaphthoquinones, phenolic acid and their derivatives, fatty acids, flavonoids, carotenoids, glycoside, dihydroisocoumarins, lignans, alkaloids, and sugars. Structures of these components are shown in tabular form. In biological studies, the crude extracts of the various species of the family Bignoniaceae show many biological properties, like antibacterial, antiviral, antifungal, antidiarrheal, anticancer, antioxidant, anticonvulsant, antidiabetic, antiplasmodial, analgesic, anti-inflammatory, antimalarial, anti-trypanosomal, antispasmodic, wound healing activity, cardioprotective, and larvicidal activity. The biological properties are also shown in tabular form.

Key Words: Bignoniaceae, Biological Properties, Traditional Uses, Phytochemistry

INTRODUCTION

According to a WHO report, the majority of traditional therapies use plant extracts and their active ingredients because they are safe and effective [1]. Over 80% of people worldwide rely on natural resources (especially plants) to treat their illnesses, either because of drug-resistant conditions or the negative side effects of modern medications [2]. Some justifications for using medicinal plants include their affordability, accessibility, and the perception that they are safer than manufactured medications [3]. The majority of herbal products are complex and vary in character, whether they are made from a single or a combination of botanical substances [4].

The existence of numerous secondary metabolites in medicinal plants, such as alkaloids, flavonoids, phenols, saponins, and sterols, may contribute to their therapeutic effects [5]. Many years ago, traditional medicinal herbs were used to treat a variety of diseases [6]. The herbs have anti-depressant, anti-asthmatic, post-coital antifertility activity, spermicidal activity, anti-parasitic activity, hepatoprotective, hypoglycaemic activity, anti-inflammatory, bronchoprotective, antiallergic, and nephroprotective properties [7].

A family of trees, shrubs, lianas, and sporadically herbaceous species is known as the Bignoniaceae [4]. It is a large family that is also known as the "trumpet vine family

Figure 1: The plants of Bignoniaceae Family (a), *Newbouldia laevis* (P.Beauv.) Seem. (b), *Campsis grandiflora* K.Schum. (c), *Zeyheria montana* Mart. (d), *Kigelia africana* (Lam.) Benth. (e), *Pyrostegia venusta* Miers (f) *Tabebuia impetiginosa* Standl

that is also known as the "trumpet vine family" or "trumpet creeper family" [8]. With more than 100 genera and around 800 species, the Bignoniaceae family is largely tropical. Figure 1 is showing few plants of Bignoniaceae Family [9]. Majority of its members scattered throughout tropical America [10].

The Bignoniaceae family includes important ornamental plants with gigantic, striking flowers [4]. The family is distinguished by the wide variety of vibrant, beautiful flowers they produce [8]. Alkaloids, flavones, polyphenols, naphthoquinones, tannins, triterpenes, seed oils, and iridoid glucosides are the main chemical constituents that are recognised in this family [11]. It consists of species which have been utilised traditionally for a variety of conditions [12] like fungus infections [13], snakebites, skin conditions, gynaecological conditions, cancer, cholera, gastrointestinal problems, respiratory issues, urinary problems, hepatic conditions, epilepsy, sexually transmitted diseases, pain, malaria, and heart conditions [14].

Traditional Uses

An antinociceptive and anti-inflammatory action has been seen in extracts of the pods, leaves, or seeds of *Catalpa bignonioides* Walter [15]. The plant *Jacaranda mimosifolia* D. Don is used to treat hepatitis. The bark, flowers, and leaves of *Jacaranda mimosifolia* are used in conventional medicine to treat neuralgia and varicose veins [16]. *Tabebuia impetiginosa Standl. contains antinociceptive, antibiotic, anti-edematogenic, and antidepressant properties* [17]. Diabetes can be treated with the *Tecoma stans* (L.) Griseb. plant [18]. Backaches, syphilis, ulcers, abscesses, rheumatism, and wounds are all treated with *Kigelia pinnata.* (Jacq.) DC. [19]. The flowers of *Spathodea campanulata* Buch.-Ham. ex DC. are used to treat ulcers in Laos, Cambodia, and Vietnam. [16]. The leaves and bark of *Markhamia stipulata* Seem. ex K.Schum. are used both internally for analgesic effects and externally to treat skin disorders in conventional Thai treatment [20]. Leaves of *Fernandoa adenophylla* (Wall. ex G.Don) Steenis are used as an external therapy for skin conditions in traditional Thai medicine [21]. White skin patches (leukoderma, vitiligo) can be treated with the help of flowers and leaves of *Fernandoa adenophylla* [22]. Brazilian folk medicine uses *Jacaranda cuspidifolia* Mart. for pectoral and vulnerable treatments, as well as for the treatment of syphilis, gonorrhoea, and skin ulcers [23].

Phyto-Constituents

Phytochemicals, which have been demonstrated to help prevent, treat, or relieve a variety of health issues, are abundant in plants and herbs [24]. Several investigations on various plant species have been conducted recently in an effort to find chemicals that could be useful for various medical uses [25].

Compounds 1–133 were isolated from medicinally important genra of Bignoniaceae (Table 1). Commonly, Naphthoquinones are the major constituents of this family. Many terpenoids, anthraquinones, benzoquinone,

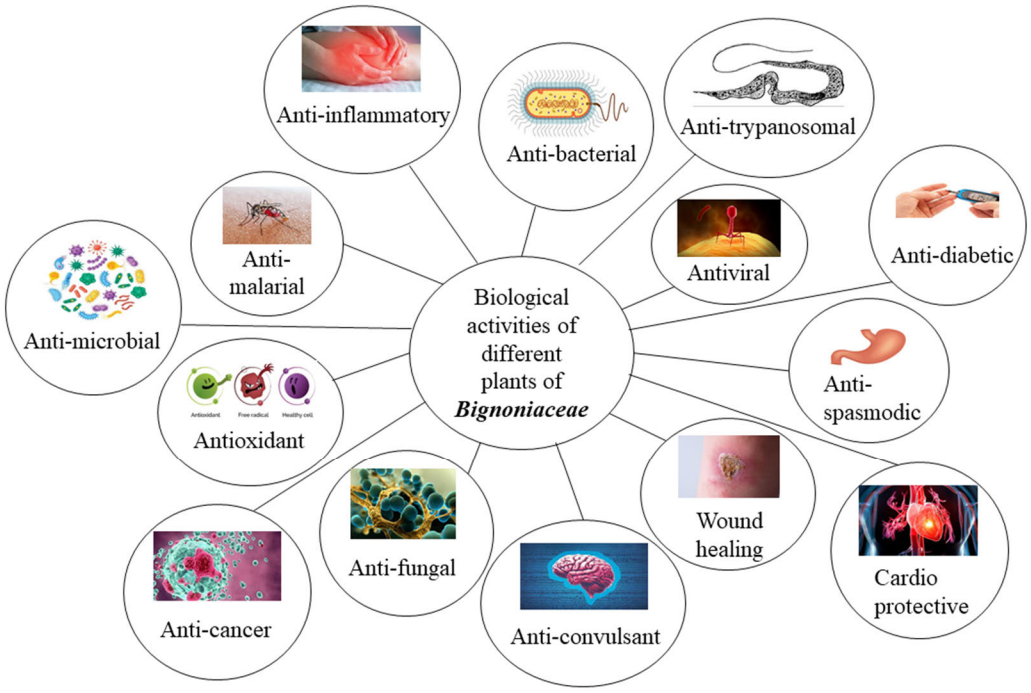


Figure 2: A Schematic Diagram of Biological Activities of Different Plants of *Bignoniaceae*

naphthoquinones, phthalide derivative, furan naphthoquinones, fatty acid, sterols, phenolic compounds, flavonoids, carotenoids, glycoside, sugars, chalcone, ferulic esters and dihydroisocoumarins are reported in this family (Figure 2).

Terpenoids, including compounds 1–18 were isolated from *Xantolis boniana var. boniana* (twig and leaf extract), *A. pulchra* Sims (aerial part extract), *A. triplinervia* (leaf extract), *N. laevis* (root extract), *C. grandiflora* (flower extaract), *Z. Montana* (leaf extract), *A. samydoides (*leaf and stem extract)*, J. Decurrens* (leaf extract), *Macfadyena unguis-cati* (liana extract), *K. africana* (leaf and fruit extract) and *H. adenophyllum* (leaf extract). Sterols and their derivatives: isolated from *R. boniana* (twig and leaf extract), *R. xylocarpa* (root extract), *A. samydoides (*leaf and stem extract)*, K. pinnatu* (roots and bark extract) and *Macfadyena unguis-cati* (liana extract) are numbered 19-23 in Table 1.

- **Anthraquinones:** isolated from *S. zenkeri* (stem-bark extract) and *T. impetiginosa* (bark extract) are numbered 24-27 in Table 1
- **Benzoquinone:** only one compound, numbered 28 was isolated from *N. laevis* (root extract)
- **Naphthoquinones:** isolated from *K. pinnatu* (root and fruit extract), *N. laevis* (root and stem-bark extract), *T. undulate* (stem-bark extract), *T. avellanedue* (stem-bark and whole plant extract), *H. adenophyllum* (stem and heartwood extract) and *C. ovate* (stem-bark extract) are numbered 29-53 in Table 1.
- **Phthalide derivative:** only one compound, numbered 54 was isolated from *C.ovate* (stem-bark extract).
- Furanonaphthoquinones: isolated from *N. laevis* (stem-bark extract), *T. ochracea* (stem-bark extract) and *T.impetiginosa* (bark extarct) are numbered 55-61 in Table 1.
- **Phenolic compounds:** isolated from *A. patellifera* (aerial part extract), *Macfadyena unguis-cati* (liana extract), *N. laevis* (stem-bark extarct), *K. pinnatu* (roots and fruit extract), *S. zenkeri* (stem-bark extract), *K. africana* (stem-bark extract), *T. aurea* (Stem-bark extract) and *A. pulchra* (aerial part extract) are numbered **62-69** in Table 1
- **Fatty acids:** isolated from *Macfadyena unguis-cati* (aerial part and seed extract) and *Pyrostegia venusta* (flower extract) are numbered 70-90 in Table 1
- **Flavonoids:** isolated from *A. samydoides* (leaves and stem extract), *A. brachypoda* (leaf and root extract), *Z. tuberculosa* (stem extract), *A. pulchra* (aerial part extarcat), *M. hortensis* (leaf and flower extract), *O.indicum* (stem-bark extract), *N. laevis* (root and stem-bark extract), *Macfadyena unguis-cati* (liana extract), *A. chica* (leaf extract) and *T. stans* (fruit extract) are numbered 91-108 in Table 1
- **Carotenoids:** isolated from *A. chica* (leaf extract) are numbered 109 and 110 in Table 1
- **Glycoside:** isolated from *S. cylindricum* (leaf and branch extract), *M. stipulate* (leaf and branch extract), *F. adenophylla* (leaf and branch extract), *J. cuspidifolia* (bark extarct), *N. laevis* (stem-bark

Table 1: Phytochemical Compounds of Family *Bignoniaceae*

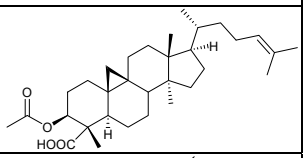
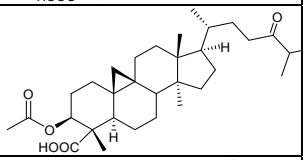
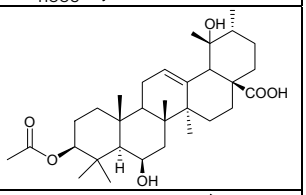
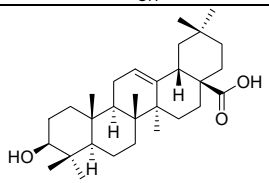
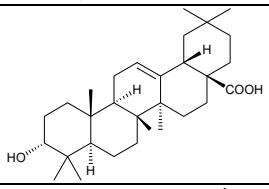
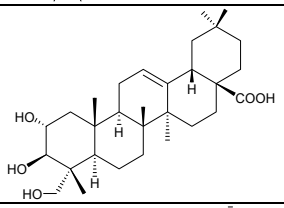
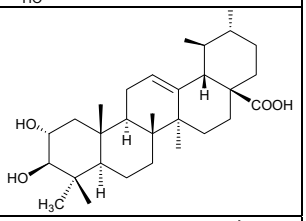
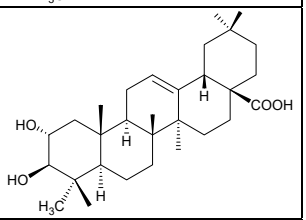
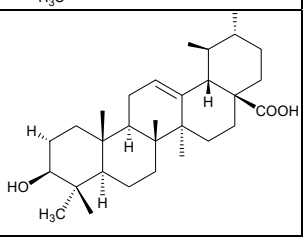
Structure No	Compound Name	Source Type	Part used	Reference.	Structures
Terpenoids					
I.Triterpenoid					
1	Bonianic acid A	*Radermachera boniana*	Twig and leaf extract	[70]	
2	Bonianic acid B	*Radermachera boniana*	Twig and leaf extract	[70]	
3	3-O-acetyluncaric acid	*Radermachera boniana*	Twig and leaf extract	[70]	
4	Oleanolic acid	*Radermachera boniana, Arrabidaea pulchra, Arrabidaea triplinervia, Newbouldia laevis, Campsis grandiflora*	Twig and leaf extract Aerial part extract Leaf extract Root extract Flower extract	[36,70,71,72]	
5	3-epioleanolic acid	*Radermachera boniana*	Twig and leaf extract	[70]	
6	Arjunolic acid	*Campsis grandiflora*	Flower extract	[72]	
7	Corosolic acid	*Campsis grandiflora*	Flower extract	[72]	
8	Maslinic acid	*Campsis grandiflora*	Flower extract	[72]	
9	Ursolic acid	*Radermachera boniana, Zeyheria Montana, Arrabidaea samydoides, Arrabidaea triplinervia, Jacaranda Decurrens, Campsis grandiflora*	Twig and leaf extract Leaf extract Leaf and stem extract Leaf extract Leaf extract Flower extract	[70,71,73,74]	

Table 1: Phytochemical Compounds of Family *Bignoniaceae* (Continue)

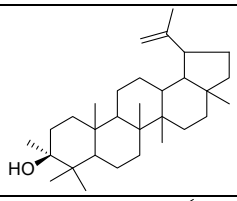
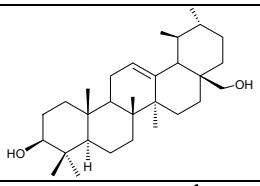
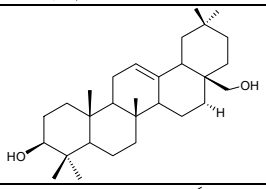
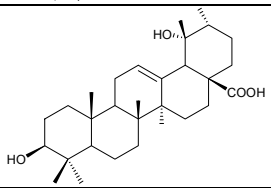
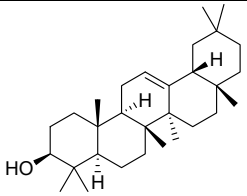
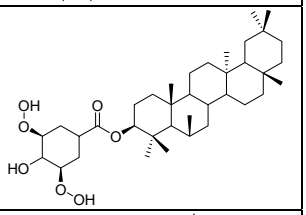
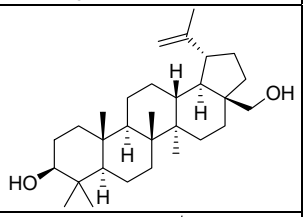
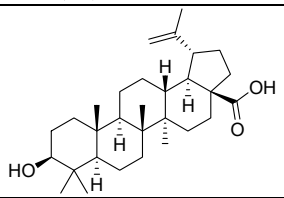
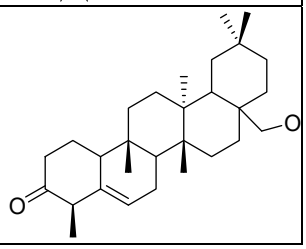
10	Lupeol	*Arrabidaea samydoides, Macfadyena unguis-cati* *Kigelia Africana*	Leaf and stem extract Liana extract Leaf extract	[71,75,76]	
11	Uvaol	*Arrabidaea samydoides*	Leaf and stem extract	[71]	
12	Erythrodiol	*Arrabidaea samydoides*	Leaf and stem extract	[71]	
13	Pomolic acid	*Arrabidaea triplinervia, Kigelia africana*	Leaf extract Leaf extract	[71,76]	
14	β-amyrin	*Haplophragma adenophyllum*	Leaf extract	[77]	
15	Fibrarecisin	*Kigelia africana*	Leaf extract	[76]	
16	Betulin	*Pyrostegia venusta*	Flower extract	[78]	
17	Betulinic acid	*Pyrostegia venusta*	Flower extract	[78]	
18	Canophyllol	*Kigelia africana*	Leaf and fruit extract	[76]	

Table 1: Phytochemical Compounds of Family *Bignoniaceae* (Continue)

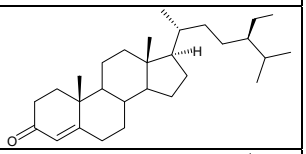
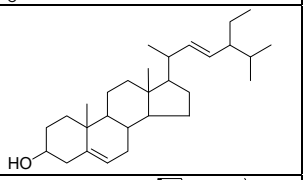
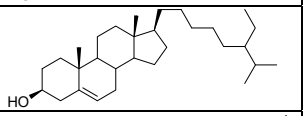
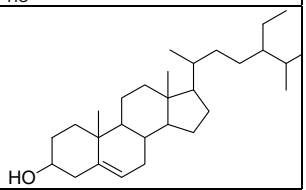
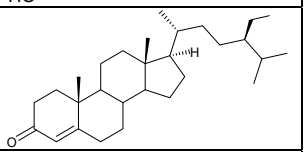
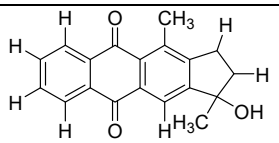
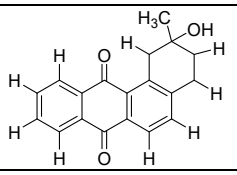
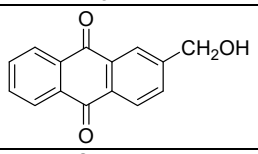
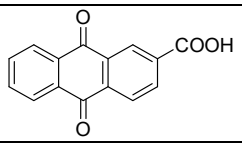
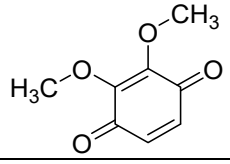
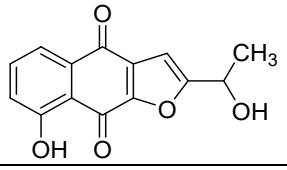
Sterols and their derivatives					
19	Ergosterol peroxide	*Radermachera boniana*	Twigs and leaf extract	[70]	
20	Stigmasterol	*Radermachera xylocarpa, Arrabidaea samydoides Kigelia pinnatu*	Root extract Leaf and stem extract Roots and bark extract	[71,79,80]	
21	Sitosterol	*Arrabidaea samydoides*	Leaf and stem extract	[71]	
22	*β*-sitosterol	*Macfadyena unguis-cati Kigelia pinnatu*	Liana extract Roots and bark extract	[75,80]	
23	β-sitostenone	*Radermachera boniana*	Twigs and leaf extract	[70]	
Anthraquinones					
24	Zenkequinones A	*Stereospermum zenkeri*	Stem-bark extract	[40]	
25	Zenkequinones B	*Stereospermum zenkeri*	Stem-bark extract	[40]	
26	2-(hydroxymethyl) anthraquinone	*Tabebuia impetiginosa*	Bark extract	[26]	
27	Anthraquinone-2-carboxylic acid	*Tabebuia impetiginosa*	Bark extract	[26]	
Benzoquinone					
28	2,3-dimethoxy-1,4-benzoquinone	*Newbouldia laevis*	Root extract	[36]	
Naphthoquinones					
29	Kigelinone	*Kigelia pinnata*	Root and fruit extract	[81]	

Table 1: Phytochemical Compounds of Family *Bignoniaceae* (Continue)

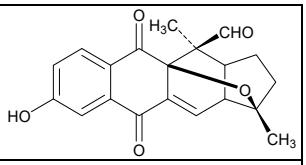
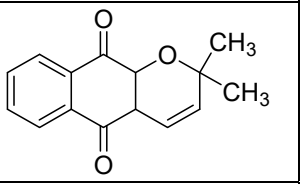
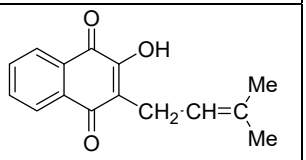
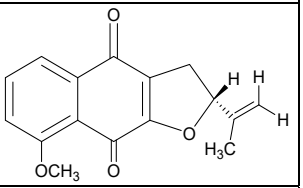
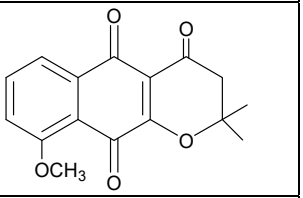
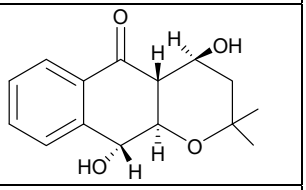
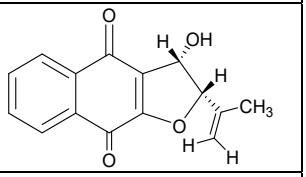
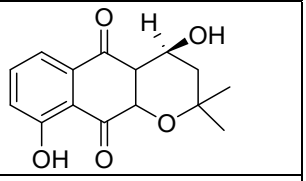
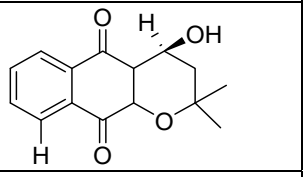
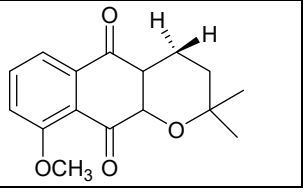
30	Isopinnatal	*Kigelia pinnata*	Root and fruit extract	[81]	
31	Dehydro-*α*-lapachone	*Kigelia pinnata*	Root and fruit extract	[81]	
32	Lapachol	*Kigelia pinnata, Newbouldia laevis, Tecomella undulate, Tubebuiu avellanedue, Heterophragma adenophyllum*	Root and fruit extract Root extract Stem-bark extract Stem-bark extract Stem-heartwood extract	[36,81,82,83,84]	
33	8-methoxydehydroiso-*α*-lapachone	*Catalpa ovate*	Stem-bark extract	[85]	
34	9-methoxy-4-oxo-*α*-lapachone	*Catalpa ovate*	Stem-bark extract	[86]	
35	(4*S*,4a*R*,10*R*,10a*R*)-4,10-dihydroxy-2,2-dimethyl-2,3,4,4 *α*,10,10 *α* hexahydrobenzo[*g*] chromen-5-one	*Catalpa ovate*	Stem-bark extract	[86]	
36	3-hydroxydehydroiso-*α*-lapachone	*Catalpa ovate* *Heterophragma adenophyllum*	Stem-bark extract Heartwood extract	[85,87]	
37	4,9-dihydroxy-*α*-lapachone	*Catalpa ovate*	Stem-bark extract	[85]	
38	4-hydroxy-*α*-lapachone	*Catalpa ovate*	Stem-bark extract	[85]	
39	9-methoxy-*α*-lapachone	*Catalpa ovate*	Stem-bark extract	[85]	

Table 1: Phytochemical Compounds of Family *Bignoniaceae* (Continue)

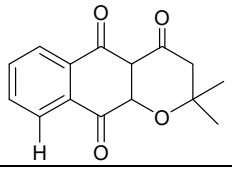
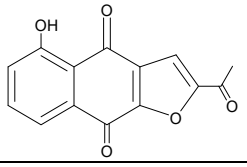
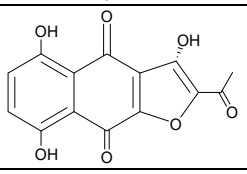
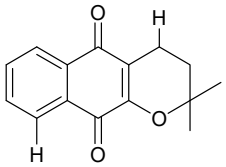
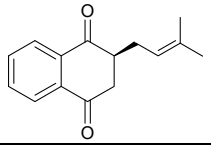
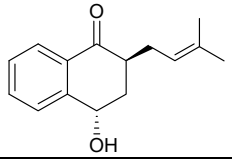
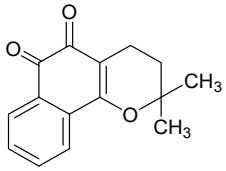
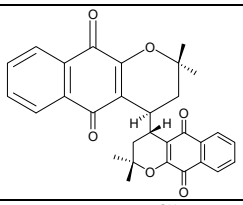
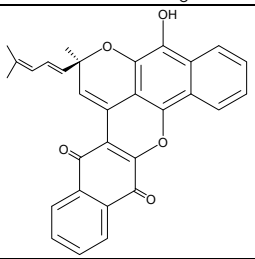
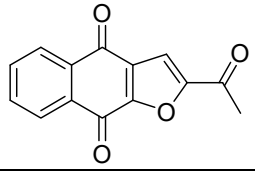
40	4-oxo-*α*-lapachone	*Catalpa ovate*		[86]	
41	5-hydroxy-dehydro-iso-*α*-lapachone	*Newbouldia laevis*	Stem-bark extract	[88]	
42	3,8-dihydroxydehydroiso-*α*-lapachone	*Heterophragma adenophyllum*	Heartwood extract	[87]	
43	*α*-lapachone	*Catalpa ovate*	Stem extract	[86]	
44	Catalponone	*Catalpa ovate*	Stem extract	[86]	
45	Catalponol	*Catalpa ovate*	Stem extract	[86]	
46	*β*-Lapachone	*Tabebuia avellanedae*	Whole plant extract	[86]	
47	Dilapachone	*Haplophragma adenophyllum*	Heartwood extract	[77]	
48	Adenophyllone	*Haplophragma adenophyllum*	Heartwood extract	[77]	
49	2-acetyl-4H,9H-naphtho[2,3-b]furan4,9-dione	*Tabebuia serratifolia*	Bark extract	[26]	

Table 1: Phytochemical Compounds of Family *Bignoniaceae* (Continue)

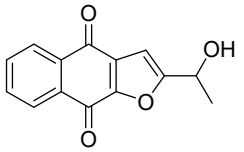
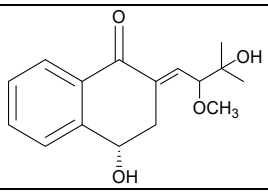
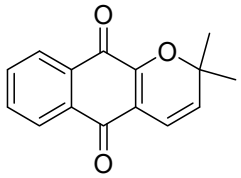
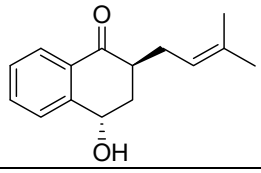
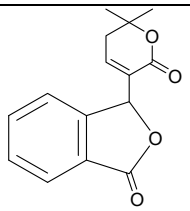
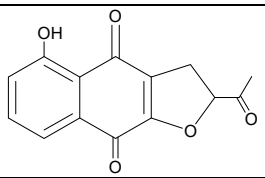
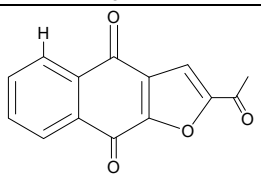
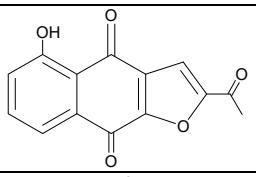
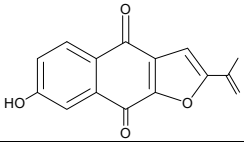
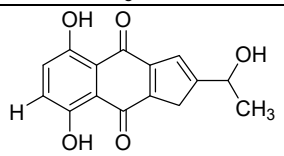
50	2-(1-hydroxyethyl)-4H,9H-naphtho[2,3-b] furano-4,9-dione	*Tabebuia serratifolia*	Bark extract	[26]	
51	4-Hydroxy-2-(3-hydroxy-2-methoxy-3-methyl-butylidene)-3,4-dihydro-2*H*-naphthalen-1-one	*Catalpa ovate*	Stem extract	[86]	
52	α-xiloidone	*Tabebuia avellanedae*	Wood extract	[29]	
53	Epicatalponol	*Catalpa bignonioides*	Heartwood extract	[89]	
Phthalide derivative					
54	Catalpalactone	*Catalpa ovate*	Stem-bark extract	[85]	
Furanonaphthoquinones					
55	5-hydroxy-dehydroiso-*α*-lapachone	*Newbouldia laevis*	Stem-bark extract	[88]	
56	2-isopropenylnaphtho[2,3-b]furan-4,9-dione	*Newbouldia laevis*	Stem-bark extract	[88]	
57	2-(1'-methylethenyl)-5-hydroxynaphtho[2,3-b]furan-4,9-dione	*Newbouldia laevis*	Stem-bark extract	[88]	
58	2-(1'-methylethenyl)-7-hydroxy-naphtho[2,3-b]furan-4,9-dione	*Newbouldia laevis*	Stem-bark extract	[88]	
59	5,8-Dihydroxy-2-(1′-hydroxyethyl)naphtho[2,3-b]- furan-4,9-dione	*Tabebuia ochracea*	Stem-bark extract	[90]	

Table 1: Phytochemical Compounds of Family *Bignoniaceae* (Continue)

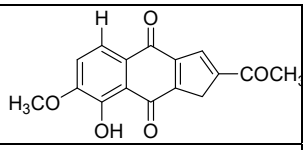
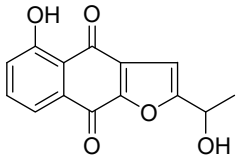
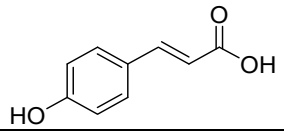
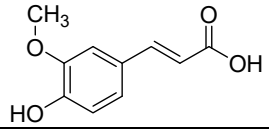
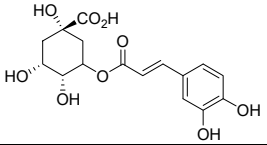
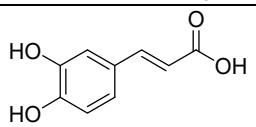
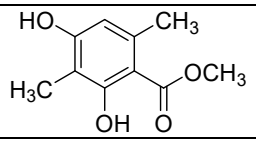
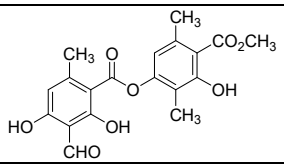
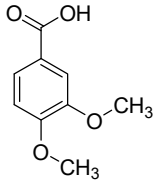
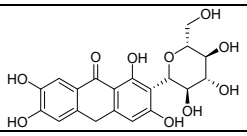
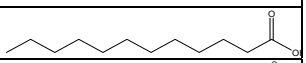
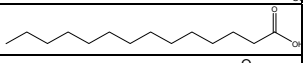
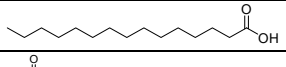
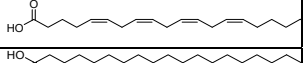
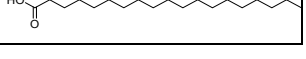
60	8-Hydroxy-7-methoxy-2-acetylnaphtho[2,3-b]furan-4,9-dione	*Tabebuia ochracea*	stem bark extract	[90]	
61	5-Hydroxy-2-(1 -hydroxyethyl)naphtho[2,3-b] furan-4,9-dione	*Tabebuia impetiginosa*	Bark extract	[91]	
Phenolic compounds					
62	*p*-Coumaric acid	*Kigelia pinnata, Arrabidaea pulchra, Stereospermum zenkeri*	Root and fruit extract Aerial part extract Stem-bark extract	[40,71,81]	
63	Ferulic acid	*Kigelia pinnata*	Root and fruit extract	[81]	
64	Chlorogenic acid	*Macfadyena unguis-cati*	Liana extract	[75]	
65	Caffeic acid	*Kigelia pinnata*	Root and fruit extract	[81]	
66	Atraric acid	*Newbouldia laevis*	Stem-bark extract	[88]	
67	Atranorin	*Kigelia africana*	Stem-bark extract	[92]	
68	Veratric acid	*Tabebuia aurea*	Stem-bark extract	[38]	
69	Mangiferin	*Arrabidaea patellifera*	Aerial part extract	[71]	
Fatty acids					
a. Saturated					
70	Dodecanoic acid (Lauric acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	
71	Tetradecanoic acid (Myristic acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	
72	Pentadecenoic acid (Pentadecylic acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	
73	Arachidonic acid (Eicosanoic acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	
74	Heneicosylic acid (Heneicosanoic acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	

Table 1: Phytochemical Compounds of Family *Bignoniaceae* (Continue)

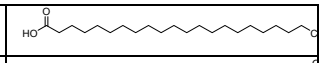
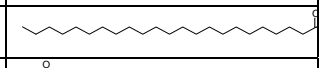
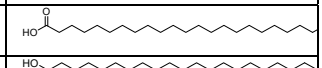
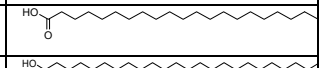
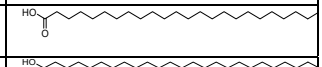
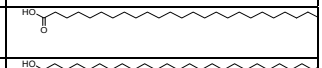
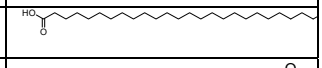
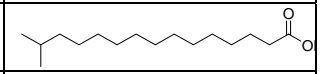
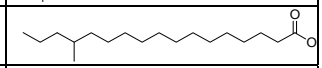
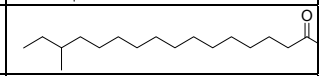
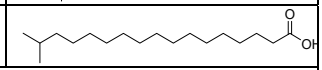
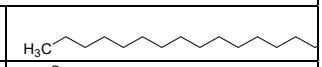
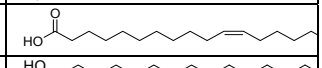
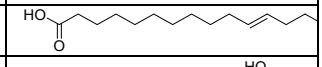
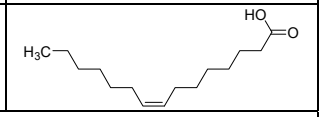
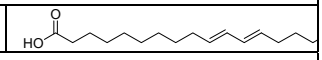
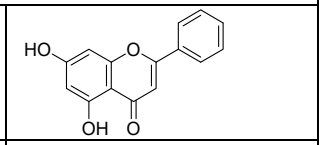
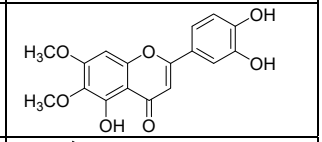
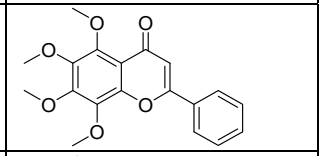
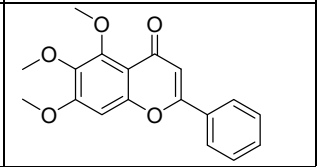
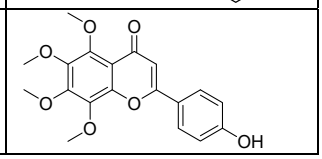
75	Behenic acid (Docosanoic acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	
76	Tricosylic acid (Tricosanoic acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	
77	Lignoceric acid (Tetracosanoic acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	
78	Pentacosylic acid (Pentacosanoic acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	
79	Cerotic acid (Hexacosanoic acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	
80	Montanic acid (Octacosanoic acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	
81	Melissic acid (Triacontanoic acid)	*Macfadyena unguis-cati*	Aerial part extract	[93]	
82	Pentadecanoic acid, 14- methyl	*Macfadyena unguis-cati*	Aerial part extract	[93]	
83	Heptadecanoic acid, 14 methyl	*Macfadyena unguis-cati*	Aerial part extract	[93]	
84	Hexadecanoic acid,14-methyl	*Macfadyena unguis-cati*	Aerial part extract	[93]	
85	Heptadecanoic acid,16-methyl	*Macfadyena unguis-cati*	Aerial part extract	[93]	
b. Monounsaturated					
86	Palmitoleic acid	*Macfadyena unguis-cati*	Seed extract	[93]	
87	*Cis*-vaccenic acid	*Macfadyena unguis-cati*	Seed extract	[93]	
88	11-hexadecenoic acid	*Macfadyena unguis-cati*	Aerial part extract	[93]	
89	Oleic acid	*Pyrostegia venusta*	Flower extract	[78]	
c. Polyunsaturated					
90	Linoleic acid	*Pyrostegia venusta*	Flower extract	[78]	
Flavonoids					
1) Flavone					
91	Chrysin	*Arrabidaea samydoides, Oroxylum indicum*	Leaf and stem extract Stem-bark extract	[71,94]	
92	Cirsiliol	*Arrabidaea brachypoda*	Leaf extract	[71]	
93	5,6,7,8-Tetramethoxyflavone	*Zeyheria tuberculosa*	Stem extract	[41]	
94	5,6,7-Trimethoxyflavone	*Zeyheria tuberculosa*	Stem extract	[41]	
95	4'-Hydroxy-5,6,7,8-tetramethoxyflavone	*Zeyheria tuberculosa*	Stem extract	[41]	

Table 1: Phytochemical Compounds of Family *Bignoniaceae* (Continue)

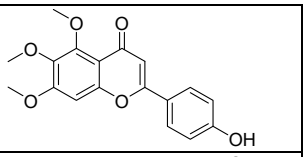
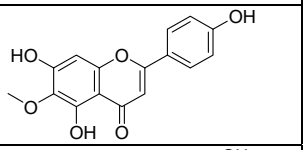
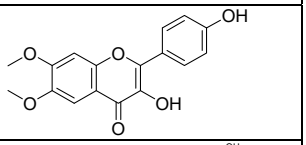
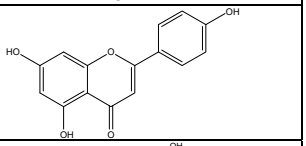
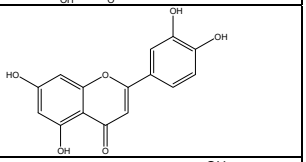
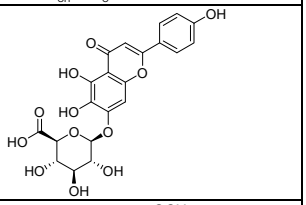
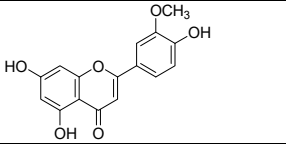
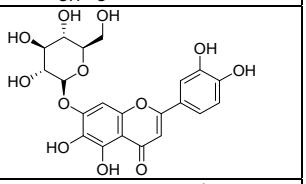
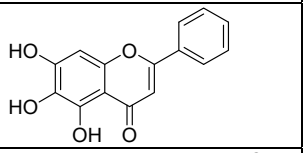
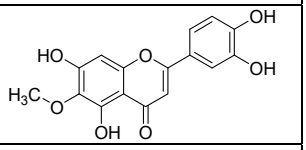
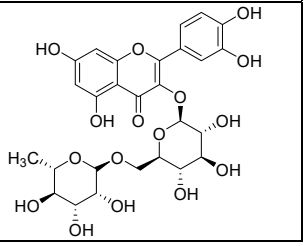
96	4'-Hydroxy-5,6,7-trimethoxyflavone	*Zeyheria tuberculosa*	Stem extract	[41]	
97	Hispidulin	*Arrabidaea brachypoda, Millingtonia hortensis*	Leaf extract Leaf and flower extract	[71,95]	
98	Hortensin	*Millingtonia hortensis*	Flower extract	[95]	
99	Apigenin	*Arrabidaea brachypoda, Newbouldia laevis*	Leaf extract Stem-bark extract	[71,76]	
100	Luteolin	*Arrabidaea brachypoda, Newbouldia laevis*	Leaf and root extract Stem bark extract	[71,76]	
101	Scutellarein	*Arrabidaea chica* *Oroxylum indicum*	Leaf extract Stem-bark extract	[71,94]	
102	Chrysoeriol	*Newbouldia laevis*	Root extract	[36]	
103	6-hydroxyluteolin-7-*O*-ß-glucoside	*Arrabidaea pulchra*	Aerial part extract	[71]	
104	Baicalein	*Oroxylum indicum*	Stem-bark extract	[94]	
105	6-Methoxyluteolin (Nepetin)	*Oroxylum indicum*	Stem-bark extract	[94]	
2) Flavonol					
106	Rutin	*Arrabidaea brachypoda* *Tecoma stans*	Leaf extract Fruit extract	[71,97]	

Table 1: Phytochemical Compounds of Family *Bignoniaceae* (Continue)

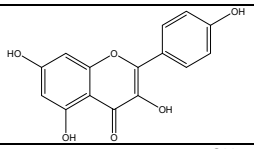
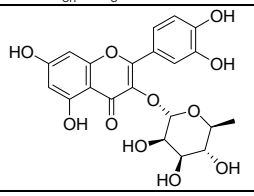
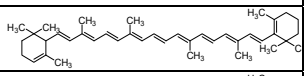
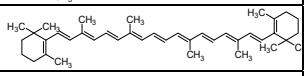
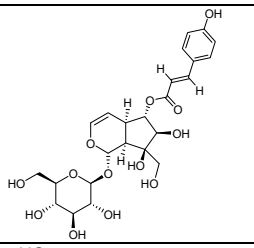
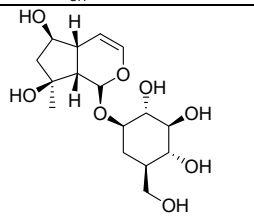
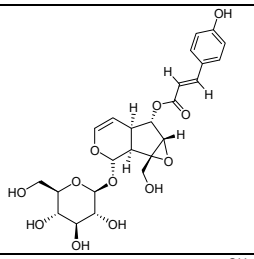
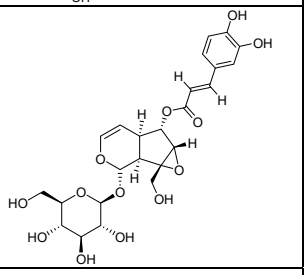
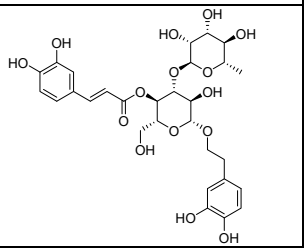
107	Kaempferol	*Arrabidaea chica*	Leaf extract	[71]	
108	Quercitrin	*Macfadyena unguis-cati*	Liana extract	[75]	
Carotenoids					
109	*α*-carotene	*Arrabidaea chica*	Leaf extract	[71]	
110	*β*-carotene	*Arrabidaea chica*	Leaf extract	[71]	
Glycoside					
a) Iridoid glucosides					
111	Stereospermoside	*Stereospermum cylindricum*	Leaf and branch extract	[98]	
112	Ajugol	*Stereospermum cylindricum*	Leaf and branch extract	[98]	
113	Specioside	*Stereospermum cylindricum*	Leaf and branch extract	[98]	
114	Verminoside	*Stereospermum cylindricum*	Leaf and branch extract	[98]	
b) phenylethanoid glycosides					
115	Verbascoside	*Arrabidaea pulchra, Jacaranda cuspidifolia, Newbouldia laevis*	Leaf extract Bark extract Stem-bark extract	[23,71,88]	

Table 1: Phytochemical Compounds of Family *Bignoniaceae* (Continue)

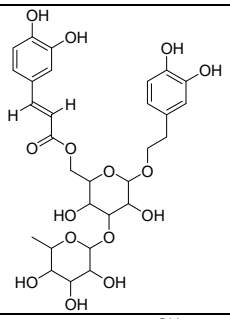
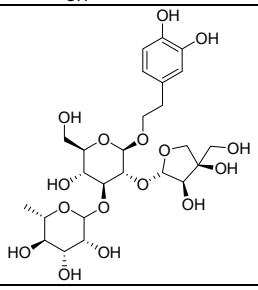
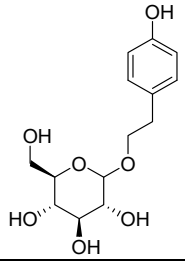
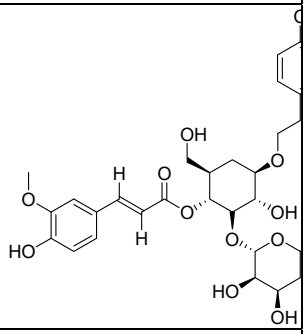
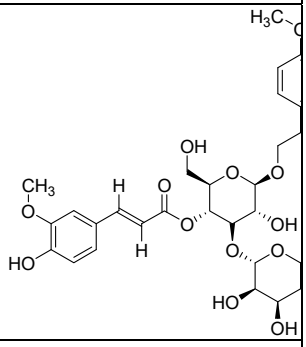
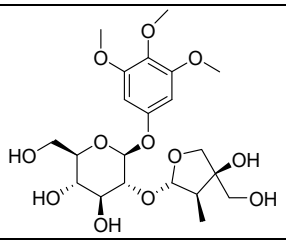
116	Isoverbascoside	*Stereospermum cylindricum*	Leaf and branch extract	[98]	
117	Markhamiosides A	*Markhamia stipulate*	Leaf and branch extract	[20]	
118	Salidroside	*Fernandoa adenophylla*	Leaf and branch extract	[21]	
119	Leucosceptoside A	*Fernandoa adenophylla*	Leaf and branch extract	[21]	
120	Martynoside	*Fernandoa adenophylla*	Leaf and branch extract	[21]	
c) Phenolic glycoside					
121	Khaephuoside A	*Barnettia kerrii*	Leaf and branch extract	[99]	

Table 1: Phytochemical Compounds of Family *Bignoniaceae* (Continue)

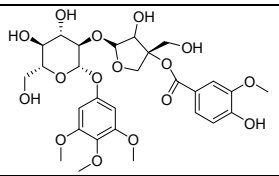
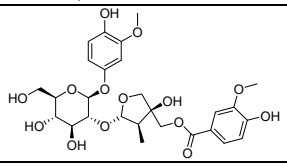
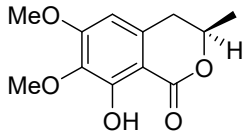
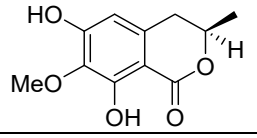
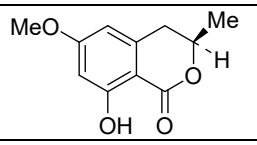
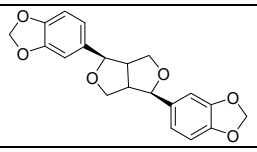
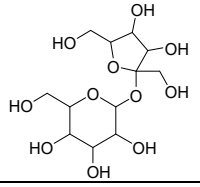
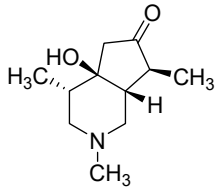
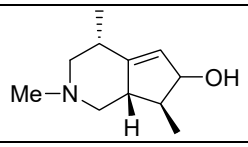
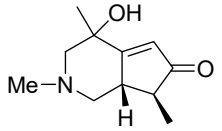
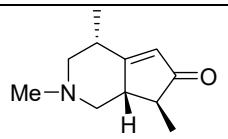
122	khaephuoside B	*Markhamia stipulate*	Leaf and branch extract	[20]	
123	Seguinoside K	*Barnettia kerrii*	Leaf and branch extract	[99]	
Dihydroisocoumarins					
124	Kigelin	*Kigelia pinnatu*	Root extract	[80]	
125	6-demethylkigelin	*Kigelia pinnatu*	Root extract	[80]	
126	6-methoxymellein	*Kigelia pinnate*	Root and bark extract	[80]	
Lignan					
127	Sesamin	*Kigelia Africana*	Leaf and fruit extract	[76]	
Sugars					
128	Sucrose	*Tecoma stans*	Fruit extract	[97]	
Alkaloids					
129	5b-Hydroxyskitanthine	*Tecoma stans*	Leaf extract	[100]	
130	7-hydroxydehydroskytanthine	*Tecoma stans*	Fruit extract	[100]	
131	4-hydroxytecomanine	*Tecoma stans*	Fruit extract	[100]	
132	Tecomanine	*Tecoma stans*	Fruit extract	[100]	

Table 2: Biological Activity of Species of Family Bignoniaceae

Biological activity	Plant sources	Inferences	Reference.
Antibacterial activity	*Tabebuia ochracea*	At doses between 1.25 and 10 mg/well, an ethyl acetate extract of inner bark of *T. ochracea* prevents the formation of *Staphylococcus aureus.*	[26,69]
	Kigelia pinnata	The methanol extract of *K. pinnata* has the highest antibacterial activity against *Proteus vulgaris* and *Salmonella typhi*, intermediate antibacterial activity against *S. aureus*, *E. coli,* and *B. cereus*, but lower antibacterial activity against *Klebsiella pneumonia, P. aeruginosa and Enterobacter aerogens.*	[27]
	Tabebuia rosea	It has also been determined that the ethanol extract derived from leaves of *T. rosea* can stop Klebsiella pneumonia from growing at doses between 50,000 and 30,000 mg/L (50 and 300 mg/mL).	[28]
	Jacaranda oxyphylla	Ethanol extracts from *J. oxyphyll* leaves were discovered to have a relevant effect against Gram-positive bacteria (*S. aureus and B. cereus*).	[37]
	Tabebuia avellanedae	*T. avellanedae's* hexane extract shown antibacterial effects against and methicillin-sensitive *Staphylococcus aureus* and methicillin-resistant *Staphylococcus aureus.*	[29]
	Tecoma stans	Leaf extract of *Tecoma stans* exhibit a potential broad spectrum antibacterial activity.	[30]
	Pyrostegia venusta	*Pyrostegia venusta* extract had antibacterial efficacy against *Salmonella typhimurium , Staphylococcus aureus, Klebsiella pneumoniae, Pseudomonas aeruginosa, Bacillus cereus, Shigella sonnei* and *Escherichia coli.*	[22]
	Tabebuia impetiginosa	*Campylobacter jejuni* was unaffected by *T. impetiginosa* hydro-alcoholic extract, which only had a 36% inhibitory effect on *Helicobacter pylori* growth.	[32]
	Tabebuia chrysantha	Dose of 125,000 mg/L (125 mg/mL) of methanolic extract of *T. chrysantha* leaf stopped the growth of *Staphylococcus aureus.*	[33]
	Jacaranda mimosaefolia	*E. coli, S. typhi, B. cereus,* and *S. aureus* are among the gram negative and gram positive bacteria that methanolic leaf extract from *Jacaranda mimosaefolia* is effective against.	[34]
	Jacaranda acutifolia	*Xanthomonas campestris* growth was suppressed by j*acaranda acutifolia* extract.	[35]
	Jacaranda cuspidifolia	*J. cuspidifolia's* methanolic extract shown antibacterial action against *S. aureus, S. Pyogenes* and *N. gonorrheae.*	[23]
	Newbouldia laevis	When compared to the standard antibiotics gentamycin and nystatin, Newbouldiaquinone A compound of *Newbouldia laevis* was 24 and 13 times more effective against *Enterobacter aerogens* and *Candida gabrata*, respectively.	[36]
Antimicrobial activity	*Tabebuia aurea*	The chemicals identified in *T. aure*a demonstrated a broad spectrum of efficacy against Gram negative and Gram positive bacteria and also against alcohol-acid bacteria and fungus in microbiological experiments	[38]
	Kigelia pinnata	*Kigelia pinnata's* crude aqueous extract shown strong antimicrobial activity.	[39]
	Stereospermum zenkeri	The best antibacterial activity against gram-negative *Pseudomonas aeruginosa* was demonstrated by the compound zenkequinone B of *Stereospermum zenkeri* (MIC 9.50 µg/mL).	[40]
	Zeyheria tuberculosa	Extracts and isolated flavones from *Z. tuberculosa* may be very effective against the pathogenic bacteria *S. aureus* and *C. albicans.*	[41]
Antifungal activity	*Tabebuia avellanedae*	Dichloromethane extract from bark of *T. avellanedae* has a significant antifungal effect, particularly against *Microsporum gypseum, Aspergillus fumigatus, Saccharomyces cerevisiae*, *Candida albicans,* and *Trichophyton mentagrophytes.*	[42]
	Tabebuia caraiba	Dose of 20,000 mg/L (20 mg/mL) of an ethanol extract from *T. caraiba* suppressed the growth of *Candida albicans.*	[43]
	Tabebuia avellanedae	*Candida parapsilosis, Candida albicans, Candida krusei, Candida dubliniensis, Candida rugosa, Candida lusitaniae, and Candida glabrata a*re all inhibited by methanol extract from *T. avellanedae,* with MIC values ranging from 60 to 0.1 mg/L (0.06 to 0.0001 mg/mL).	[44]
	Tecoma stans	Extracts demonstrated antifungal efficacy against *Candida albicans, Cryptococcus neoformans,* and *Microsporum gypsum.*	[45]
Antiviral activity	*Tabebuia impetiginosa*	The extract of *Tabebuia impetiginosa* exhibited anti-HHV-1 action, with an EC_{50} of 166.6 µg/mL.	[46]
Antidiarrhoeal activity	*Kigelia pinnata*	When compared to atropine, the antidiarrheal impact of *Kigelia pinnata* at 500 mg/kg was found to be 82% and 62.7% on small intestine motility and castor oil-induced diarrhoea, respectively.	[47]
Anticancer activity	*Kigelia pinnata*	Methanolic extract of *Kigelia pinnata* significantly killed off human tumour cell lines.	[48]
	Tabebuia avellanedae	When taken orally, *Tabebuia avellanedae's* aqueous extract reduced the nociception caused by acetic acid.	[50]
	Tecoma stans	The leaf extract from *Tecoma stans* shown a considerable antiproliferative action. At concentrations of 7.8 g/mL and 1000 g/mL, extracts demonstrated minimum inhibition of 14.6% and maximal inhibition of 95.9%, respectively.	[49]

Table 2: Biological Activity of Species of Family Bignoniaceae (Continue)

	Kigelia pinnata	Due to the existence of a high phenolic content, the ethyl acetate fraction of root of *Kigelia pinnata* exhibits excellent antioxidant activity against DPPH. It has strong antioxidant properties that prevent peroxidation of lipid, lower level of glutathione, and increase CAT and SOD activity.	Atolani *et al.*
	Pyrostegia venusta	The fraction of ethyl acetate from *Pyrostegia venusta* roots demonstrates good antioxidant property against DPPH because it has a high phenolic content.	[31]
	Tecoma stans	Dose of 20 µg/mL of methanolic extract from *T. stans* demonstrated significant antioxidant activity.	[51]
	Tabebuia impetiginosa	The methanolic extract and syrup of *Tabebuia impetiginosa* had strongest antioxidant activity.	[17]
Antidiabetic activity	*Parmentiera edulis*	After being given to rats with alloxan-induced diabetes, the substance lactucin-8-O-methylacrylate of *Parmentiera edulis* reduces sugar levels in blood.	[33]
	Tecoma stans	*Tecoma stans* stimulates glucose absorption in both insulin-resistant and insulin-sensitive human and murine adipocytes, contributing to its anti-diabetic properties.	[52]
	Kigelia pinnata	The amylase inhibition assay was used to evaluate the anti-diabetic effect from leaf extract of *Kigelia pinnata* and results showed that it has strong efficacy against diabetes.	[53]
Anti-convulsant activity	*Spathodea campanulata*	Following oral administration, an ethanol extract of *S. campanulata* has anticonvulsant properties against PTZ, picrotoxin and MES-induced seizures in mice.	[101]
	Kigelia pinnata	PTZ (pentylene tetrazole) and MES (maximal 45 electro shock) induced convulsions were significantly prevented by methanolic extract of *Kigelia pinnata.*	[54]
Anti-plasmodial activity	*Spathodea campanulata*	Aqueous extract of leaf and the most polar portion of the chloroform extract of *Spathodea campanulata* showed a high amount of activity against Plasmodium herghei berghei in mice.	[55]
Anti-inflammatory activity	*Tabebuia avellanedae*	The expression of iNOS and COX-II, arachidonic acid-induced ear edoema and the production of NO and PGE2 were all inhibited by *Tabebuia avellanedae* water extract through preventing the phosphorylation of ERK.	[59]
	Jacaranda decurrens	Without inducing acute toxicity, *jacaranda decurrens* extract exhibits anti-inflammatory effects in rats.	[58]
	Pyrostegia venusta	30-300 mg/kg oral administration of hydroethanolic extract of *Pyrostegia venusta* showed an anti-inflammatory effect. Paw edoema was reduced and leukocyte migration into the peritoneal cavity was prevented by hydroethanolic extract of *Pyrostegia venusta*.	[56]
	Kigelia pinnata	The ethanolic extract of *Kigelia pinnata's* stem bark has been shown to have strong anti-inflammatory effects.	[57]
	Tabebuia impetiginosa	The generation of NO and PGE2, as well as the mRNA levels of COX-2 and iNOS was reduced by a water extract of *Tabebuia impetiginosa.*	[17]
Analgesic activity	*Stereospermum kunthianum*	The findings suggest that the analgesic activity from stem-bark of *kunthianum* in its aqueous extract is mediated by peripheral and central processes.	[61]
	Kigelia pinnata	*K. pinnata* leaf extract significantly reduced the pain caused by thermal noxious stimuli.	[60]
Larvicidal activity	*Millingtonia hortensis*	When tested on the three mosquito species *Anopheles Stephensi, Aedes Aegypti,* and *Culex quinquefasciatus*, acetone extract of the leaves of *illingtonia hortensis* was effective against all larval stages of these species.	[62]
Antinociceptive activity	*Pyrostegia venusta*	In Swiss male mice exposed to acetic acid-induced writhing, extracts of *Pyrostegia venusta* demonstrated antinociceptive action.	[56]
Cardioprotective effect	*Tecoma stans*	In a dose-dependent way, treatment with a 70% ethanolic extract of *T. stans* flowers has blocked the decline of GSH, SOD, and CAT levels.	[63]
Wound healing activity	*Pyrostegia venusta*	Pyrostegia venusta extract has a strong capacity for wound healing. Pyrostegia venusta extract was discovered to up-regulate TNF- α and IL-6 levels during the early stages of wound healing.	[22]
	Tecoma stans	In excision and incision wound models, *Tecoma stans* bark methanolic extract exhibits greater wound healing properties than chloroform and petroleum ether extracts.	[64]
Antispasmodic effect	*Tecoma stans*	Without involving β-adrenoceptors, opioid receptors, potassium channels, or NO generation, *Tecoma stans* leaf extract produces its antispasmodic actions.	[65]
Antimalarial activity	*Newbouldia laevis*	*In vitro* parasitic development of *Plasmodium falciparum* is moderately chemo-suppressed by the antimalarial compound Newbouldiaquinone A of *Newbouldia laevis.*	[66]
	Kigelia pinnata	The antimalarial efficacy of wood extract of Kigelia pinnata is superior to chloroquine and quinine against drug-resistant strains of Plasmodium falciparum.	[67]
Anti-trypanosomal activity	*Tabebuia pulcherrima*	After only 48 hours, leaf extract from *T. pulcherrima* revealed IC_{50} values of 7.8 g/mL.	[68]
	Tabebuia pallida	After only 48 hours, leaf extract from *T. pallida* revealed IC_{50} values of 7.2 g/mL.	[68]
	Tabebuia rosea	After 48 and 72 hours, an extract of the stem of *T. rosea* exhibited activity with IC_{50} of 13.4 and 16.2 g/mL, respectively.	[68]
	Tabebuia serratifolia	The chloroform extract of bark of *T. serratifolia* was reported to be effective against Trypa-nosoma cruzi with an inhibition percent greater than 96%.	[69]

extarct), *Barnettia kerrii* (Leaf and branch extract) and *A. pulchra* (leaf exatrct) are numbered 111-123 in Table 1.

- **Dihydroisocoumarins:** isolated from *K. pinnatu* (root and bark extract) are numbered 124-126 in Table 1
- **Lignans:** only one compound, numbered 127 was isolated from *Kigelia Africana* (leaf and fruit extract)
- **Sugars:** only one compound, numbered 128 was isolated from *Tecoma stans* (fruit extract)
- **Alkaloids:** isolated from *Tecoma stans* (leaf and fruit extract) are numbered 129-132 in Table 1

Biological Properties

The Bignoniaceae family has medicinal value because it contains secondary metabolites like fatty acids, glycosides, terpenoids, phenolic compounds naphthoquinones, alkaloids, flavonoids, and carotenoids. The biological activities of numerous species of the Bignoniaceae family are shown below in Table 2.

Antibacterial Activity

At doses between 1.25 and 10 mg/well, an ethyl acetate extract of inner bark of *T. ochracea* prevents the formation of *Staphylococcus aureus* [26]. The methanol extract of *K. pinnata* has the highest antibacterial activity against *Proteus vulgaris* and *Salmonella typhi*, intermediate antibacterial activity against *S. aureus*, *E. coli,* and *B. cereus*, but lower antibacterial activity against *Klebsiella pneumonia, P. aeruginosa and Enterobacter aerogens* [27]. It has also been determined that the ethanol extract derived from leaves of *T. rosea* can stop Klebsiella pneumonia from growing at doses between 50,000 and 30,000 mg/L (50 and 300 mg/mL) [28]. *T. avellanedae's* hexane extract shown antibacterial effects against and methicillin-sensitive *Staphylococcus aureus* and methicillin-resistant *Staphylococcus aureus* [29]. Leaf extract of *T. stans* exhibit a potential broad spectrum antibacterial activity [30]. *Pyrostegia venusta* extract had antibacterial efficacy against *Salmonella typhimurium , Staphylococcus aureus, Klebsiella pneumoniae, Pseudomonas aeruginosa, Bacillus cereus, Shigella sonnei* and *Escherichia coli* [31]. *Campylobacter jejuni* was unaffected by *T. impetiginosa* hydro-alcoholic extract, which only had a 36% inhibitory effect on *Helicobacter pylori* growth [32]. Dose of 125,000 mg/L (125 mg/mL) of methanolic extract of *T. chrysantha* leaf stopped the growth of *Staphylococcus aureus* [33]. *J. cuspidifolia's* methanolic extract shown antibacterial action against *S. aureus, S. Pyogenes* and *N. gonorrheae* [23]. *E. coli, S. typhi, B. cereus,* and *S. aureus* are among the gram negative and gram positive bacteria that methanolic leaf extract from *Jacaranda mimosaefolia* is effective against [34]. *Xanthomonas campestris* growth was suppressed by j*. acutifolia* extract [35]. When compared to the standard antibiotics gentamycin and nystatin, Newbouldiaquinone A compound of *Newbouldia laevis* was 24 and 13 times more effective against *Enterobacter aerogens* and *Candida gabrata*, respectively [36]. Ethanol extracts from *J. oxyphyll* leaves were discovered to have a relevant effect against Gram-positive bacteria (*S. aureus and B. cereus*) [37].

Antimicrobial Activity

The chemicals identified in *T. aure*a demonstrated a broad spectrum of efficacy against Gram negative and Gram positive bacteria and also against alcohol-acid bacteria and fungus in microbiological experiments [38]. *Kigelia pinnata's* crude aqueous extract shown strong antimicrobial activity [39]. The best antibacterial activity against gram-negative *Pseudomonas aeruginosa* was demonstrated by the compound zenkequinone B of *Stereospermum zenkeri* (MIC 9.50 µg/mL) [40]. Extracts and isolated flavones from *Z. tuberculosa* may be very effective against the pathogenic bacteria *S. aureus* and *C. albicans* [41].

Antifungal Activity

Dichloromethane extract from bark of *T. avellanedae* has a significant antifungal effect, particularly against *Microsporum gypseum, Aspergillus fumigatus, Saccharomyces cerevisiae, Candida albicans,* and *Trichophyton mentagrophytes* [42]. Dose of 20,000 mg/L (20 mg/mL) of an ethanol extract from *T. caraiba* suppressed the growth of *Candida albicans* [43]. *Candida parapsilosis, Candida albicans, Candida krusei, Candida dubliniensis, Candida rugosa, Candida lusitaniae, and Candida glabrata a*re all inhibited by methanol extract from *T. avellanedae,* with MIC values ranging from 60 to 0.1 mg/L (0.06 to 0.0001 mg/mL) [44]. Extracts of *Tecoma stans* demonstrated antifungal efficacy against *Candida albicans, Cryptococcus neoformans,* and *Microsporum gypsum* [45].

Antiviral Aactivity

The extract from *T. impetiginosa* shown anti-HHV-1 action, with an EC_{50} value of 166.6 µg/mL [46].

Antidiarrhoeal

When compared to atropine, the antidiarrheal impact of *Kigelia pinnata* at 500 mg/kg was found to be 82% and 62.7% on small intestine motility and castor oil-induced diarrhoea, respectively [47].

Anticancer

Methanolic extract of *Kigelia pinnata* significantly killed off human tumour cell lines [48]. The leaf extract from *Tecoma stans* shown a considerable antiproliferative action. At concentrations of 7.8 g/mL and 1000 g/mL, extracts demonstrated minimum inhibition of 14.6% and maximal inhibition of 95.9%, respectively [49]. When taken orally, *Tabebuia avellanedae's* aqueous extract reduced the nociception caused by acetic acid [50].

Antioxidant Activity
Due to the existence of a high phenolic content, the ethyl acetate fraction of root of *Kigelia pinnata* exhibits excellent antioxidant activity against DPPH. It has strong antioxidant properties that prevent peroxidation of lipid, lower level of glutathione, and increase CAT and SOD activity. The fraction of ethyl acetate from *Pyrostegia venusta* roots demonstrates good antioxidant property against DPPH because it has a high phenolic content [31]. The methanolic extract and syrup of *Tabebuia impetiginosa* had strongest antioxidant activity [17]. Dose of 20 µg/mL of methanolic extract from *T. stans* demonstrated significant antioxidant activity [51].

Anti-Diabetic Activity
Tecoma stans stimulates glucose absorption in both insulin-resistant and insulin-sensitive human and murine adipocytes, contributing to its anti-diabetic properties [52]. The amylase inhibition assay was used to evaluate the anti-diabetic effect from leaf extract of *Kigelia pinnata* and results showed that it has strong efficacy against diabetes [53]. After being given to rats with alloxan-induced diabetes, the substance lactucin-8-O-methylacrylate of *Parmentiera edulis* reduces sugar levels in blood [33].

Anti-Convulsant Activity
After oral administration, an ethanol extract from *S. campanulata* has anticonvulsant properties against pentylene tetrazole (PTZ), picrotoxin and maximal 45 electro shock (MES) induced seizures in mice. PTZ and MES induced convulsions were significantly prevented by methanolic extract of *Kigelia pinnata* [54].

Antiplasmodial Activity
Aqueous extract of leaf and the most polar portion of the chloroform extract of *Spathodea campanulata* showed a high amount of activity against Plasmodium herghei berghei in mice [55].

Anti-Inflammatory
30-300 mg/kg oral administration of hydroethanolic extract of *Pyrostegia venusta* showed an anti-inflammatory effect. Paw edoema was reduced and leukocyte migration into the peritoneal cavity was prevented by hydroethanolic extract of *Pyrostegia venusta* [56]. The ethanolic extract of *Kigelia pinnata's* stem bark has been shown to have strong anti-inflammatory effects [57]. The generation of NO and PGE2, as well as the mRNA level of iNOS and COX-2 was reduced by a water extract of *Tabebuia impetiginosa* [17]. Without inducing acute toxicity, *Jacaranda decurrens* extract exhibits anti-inflammatory effects in rats [58]. The expression of iNOS and COX-II, arachidonic acid-induced ear edoema and the production of NO and PGE2 were all inhibited by *Tabebuia avellanedae* water extract through preventing the phosphorylation of ERK [59].

Analgesic Activity
K. pinnata leaf extract significantly reduced the pain caused by thermal noxious stimuli [60]. The findings suggest that the analgesic activity from stem-bark of *Stereospermum kunthianum* in its aqueous extract is mediated by peripheral and central processes [61].

Larvicidal Activity
When tested on the three mosquito species *Anopheles Stephensi, Aedes Aegypti,* and *Culex quinquefasciatus*, acetone extract of the leaves of *illingtonia hortensis* was effective against all larval stages of these species [62].

Antinociceptive Activity
In Swiss male mice exposed to acetic acid-induced writhing, extracts of *Pyrostegia venusta* demonstrated antinociceptive action [56].

Cardioprotective Effect
In a dose-dependent way, treatment with a 70% ethanolic extract of *T. stans* flowers has blocked the decline of GSH, SOD, and CAT levels [63].

Wound Healing Activity
Pyrostegia venusta extract has a strong capacity for wound healing. Extract was discovered to up-regulate TNF- α and IL-6 levels during the early stages of wound healing [22]. In excision and incision wound models, *Tecoma stans* bark methanolic extract exhibits greater wound healing properties than chloroform and petroleum ether extracts [64].

Antispasmodic Effect
Without involving β-adrenoceptors, opioid receptors, potassium channels, or NO generation, *Tecoma stans* leaf extract produces its antispasmodic actions [65].

Antimalarial
In vitro parasitic development of *Plasmodium falciparum* is moderately chemo-suppressed by the antimalarial compound Newbouldiaquinone A of *Newbouldia laevis* [66]. The antimalarial efficacy of wood extract of *Kigelia pinnata* is superior to chloroquine and quinine against drug-resistant strains of Plasmodium falciparum [67].

Anti-Trypanosomal Activity
After only 48 hours, leaf extract from *T. pulcherrima* revealed IC_{50} values of 7.8 g/mL. After only 48 hours, leaf extract from *T. pallida* revealed IC_{50} of 7.2 g/mL. After 48 and 72 hours, an extract of the stem of *T. rosea* exhibited activity with IC_{50} of 13.4 and 16.2 g/mL, respectively [68]. Chloroform extract of bark of *T. serratifolia* was reported to be effective against Trypanosoma cruzi with an inhibition percent greater than 96% [69].

Future perspective

Based on available data on medicinal plant of the Bignoniaceae family, these plants are used in treatment of disease like hepatitis, neuralgia, diabetes, backaches, syphilis, ulcers, abscesses, white skin patches, rheumatism, syphilis, gonorrhoea, and ulcers. This family can therefore have regarded as a significant family in folk medicinal practices. It is because of the presence of phytochemical constituents that have many effective biological activities, and this could potentially aid researchers in the discovery of novel natural drugs. Therefore, plants of Bignoniaceae family can become significant sources of novel drugs and lead compound. A clinical trial must be conducted to better understand their safety and efficacy. Other species that have not yet been investigated should be the subject of more research.

CONCLUSION

This review focuses on phytochemical components of various species of family Bignoniaceae and also highlights the importance of these species. The plants of this family possess high amounts of secondary metabolites such as anthraquinones, sterols, terpenoids, benzoquinone, flavonoids, naphthoquinones, furanonaphthoquinones, carotenoids, glycoside, and sugars. Overall 132 compounds of this family are highlighted in this review. Due to the presence of these compounds, species belonging to the family Bignoniaceae are considered to be an important resource for treating various ailments like antibacterial, antiviral, antifungal, antidiarrheal, anticancer, antioxidant, anticonvulsant, antidiabetic, analgesic, antimalarial, anti-trypanosomal, and cardioprotective.

Conflict of Interest

All authors declare no competing interests.

Credit Authorship Statement

M.Sajid Hamid Akash, participated in literature analysis and manuscript editing. Malik Saadullah, contributed to the conception of the study. Maryam Farrukh designed the main structure of the manuscript. Aiman Atiq and Hamza Sohail done the manuscript editing. All authors reviewed and approved the final version of manuscript.

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