Phytochemistry and biological activity of family "Urticaceae": a review (1957-2019)

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Abstract

Family Urticaceae is a major family of angiosperms comprises 54 genera and more than 2000 species of herbs, shrubs, small trees and a few vines distributed in the tropical regions. Family Urticaceae has many biological importance of angiosperms due to its various phytoconstituents and valuable medicinal uses. Reviewing the current available literature showed many reports about the phytoconstituents present in many plants of the family Urticaceae. These constituents include triterpenes, sterols, flavonoids, lignans, sesquiterpenes, alkaloids, simple phenolic compounds and miscellaneous compounds which are responsible for its biological activities such as cytotoxic, antimicrobial (antibacterial, antifungal and antiviral) anti-inflammatory, antidiabetic, anti-benign prostatic hyperplasia, hepatoprotective, antioxidant as well as wound healing. Genus Urtica is the most investigated (phytochemically and biologically) in all genera of family "Urticaceae". Very few literature was found in phytochemical and biological studies on many genera of family "Urticaceae". This provoked the researchers to carry out extensive studies on these plants.

Key words

Urticaceae, phytochemistry, biological activity

1. Introduction

Natural products have widespread important consideration in the current years because of its medicinal value. Many families of medicinal plants have biological importance viz., Urticaceae, Bignoniaceae,…etc. [1-3]. Urticaceae (syn.: Urticaceae) includes about 2000 species in 54 genera- most of which in the tropical regions [4]. Family "Urticaceae" was classified taxonomically as; Kingdom: Plantae, Phylum: Tracheophyta, Class: Magnoliopsida, Order: Rosales [5]. Urticaceous plants are herbs and shrubs, but some are trees in which the xylem is very soft due to the presence of un lignified parenchyma. Stems of Urticaceous plants are often fibrous, sometimes succulent, sometimes armed with stinging hairs. The stinging hairs occurs in some of the other genera, but not universally present throughout the family. The heads of these hairs are easily detached, liberating an irritating fluid, of uncertain chemical composition [5]. Urticaceae have opposite or alternate simple leaves. Plants are mostly anemophilous and dioecious, monoecious or polygamous. Flowers are unisexual, small and individually inconspicuous, mainly in axillary or terminal spike-like cymose inflorescences. Male flowers contain four to five stamens and the female flowers present four, sometimes five sepal, or no perianth and an ovary superior. Fruits are achenes [6].

This review potentiates the researchers for carrying out further studies on this family to isolate and develop new drugs from natural sources with wide margin of safety and understanding their effects and possible mechanism of actions. The literature was collected from 1957 to 2019 using various databases including Dictionary of Natural Products (DNP), PubMed, Science Direct, ChemWeb and Google Scholar.

2. Results and discussion

2.1 Phytochemistry

On reviewing the current available literature, family Urticaceae contained various phytochemical constituents such as triterpenes, sterols, flavonoids, lignans, sesquiterpenes, alkaloids, simple phenolics and miscellaneous compounds. Their isolated compounds as well as their chemical structures are shown in (Table 1) and (Figure 1).

Results of chemical review [Table 1 and Figures (1&2)] showed the following:

1- Genus Urtica is the major genus in family Urticaceae and showed 69 isolated compounds, classified as (2 triterpenes, 12 sterols, 14 flavonoids, 9 lignans, one alkaloid, 25 simple phenolics and 6 miscellaneous compounds).

2- Genus Boehmeria showed 35 isolated compounds, classified as (5 triterpenes, one sterol, 11 flavonoids, 8 alkaloids, one simple phenolic and 9 miscellaneous compounds).

3- Genus Cecropia showed 33 isolated compounds, classified as (14 triterpenes, 2 sterols, 8 flavonoids, 4 simple phenolics and 5 miscellaneous compounds).
| No. | Name                                           | Plant source                  | Organ          | Ref. |
|-----|------------------------------------------------|------------------------------|----------------|------|
|     | **I-Triterpenes**                               |                              |                |      |
| 1   | 2-α-Acetoxy-3β,19α-dihydroxy-11α,12α-epoxy-ursan-28,13β-olide | *Cecropia pachystachya* Trecul. | Roots          | [7]  |
| 2   | 3β-Acetoxy-2α,19α-dihydroxy-11α,12α-epoxy-ursan-28,13β-olide | *Cecropia pachystachya* Trecul. | Roots          | [7]  |
| 3   | 2-Acetyl methyl tormentate                      | *Myrianthus arboreus* P. Beauv. | Root-wood      | [8]  |
| 4   | 2-Acetyl tormentic acid                         | *Myrianthus arboreus* P. Beauv. | Root-wood      | [8]  |
| 5   | 3-Acetyl methyl tormentate                      | *Myrianthus arboreus* P. Beauv. | Root-wood      | [8]  |
| 6   | 3-Acetyl tormentic acid                         | *Myrianthus arboreus* P. Beauv. | Root-wood      | [8]  |
| 7   | Arjunolic acid                                 | *Cecropia schreberiana* Miq.  | Leaves         | [9]  |
| 8   | α-Amyrin                                       | *Cecropia schreberiana* Miq.  | Leaves         | [9]  |
| 9   | β-Amyrin                                       | *Urtica dioica* L.            | Whole plant    | [10] |
|     |                                               | *Forsskaolea tenacissima* L.  | Whole plant    | [11] |
| 10  | β-Amyrinone                                    | *Cecropia obtusa* Trecul.     | Leaves         | [12] |
| 11  | Boehmerone                                     | *Boehmeria excels* Wedd.      | Stem barks     | [13] |
| 12  | 3β,19α-Dihydroxy-urs-12-ene                    | *Debregeasia salicifolia* (D.Don) | Whole plant | [14] |
| 13  | 3β,19α-Dihydroxy-30-norurs-12-ene               | *Debregeasia salicifolia* (D.Don) | Stems       | [15] |
| 14  | Euscaphic acid                                 | *Myrianthus arboreus* P. Beauv. | Root-wood     | [8]  |
| 15  | Friedelin                                      | *Forsskaolea tenacissima* L.  | Whole plant    | [11] |
| 16  | Goreishic acid I                               | *Cecropia telenitida* Cuatrec. | Roots         | [16] |
| 17  | Hederagenin                                    | *Boehmeria nivea* L.          | Roots          | [17] |
| 18  | 20-Hydroxy ursolic acid                        | *Cecropia telenitida* Cuatrec. | Roots         | [16] |
| 19  | 2α-Hydroxy ursolic acid                        | *Boehmeria nivea* L.          | Roots          | [17] |
| 20  | Isoarjunolic acid                              | *Cecropia pachystachya* Trecul. | Roots        | [7]  |
| 21  | Lupeol                                         | *Forsskaolea tenacissima* L.  | Aerial parts   | [18] |
|     |                                               | *Forsskaolea tenacissima* L.  | Whole plant    | [11] |
| 22  | Maslinic acid                                  | *Forsskaolea tenacissima* L.  | Aerial parts   | [18] |
|     |                                               | *Boehmeria nivea* L.          | Roots          | [17] |
| 23  | Methyl arjunolate                              | *Myrianthus arboreus* P. Beauv. | Root-wood     | [8]  |
| 24  | Methyl triacetyl arjunolate                    | *Myrianthus arboreus* P. Beauv. | Root-wood     | [8]  |
| 25  | Myriantonic acid                               | *Myrianthus arboreus* P. Beauv. | Root-wood     | [8]  |
| 26  | 2-O-Acetyl-euscaphic acid                      | *Cecropia pachystachya* Trecul. | Roots       | [7]  |
| 27  | Oleanolic acid                                 | *Urtica dioica* L.            | Whole plant    | [10] |
| 28  | Oxo-oleanolic acid                             | *Pilea mongolica* Wedd.       | Aerial parts   | [19] |
| 29  | 2α,3β,21β,23,28-Penta hydroxyl 12-oleanene     | *Laportea crenulata* Gaud.    | Roots          | [20] |
| 30  | Pomolic acid                                   | *Cecropia schreberiana* Miq.  | Leaves         | [9]  |
|     |                                               | *Debregeasia salicifolia* (D.Don) | Whole plant | [14] |
| 31  | Pomolic acid methyl ester                      | *Debregeasia salicifolia* (D.Don) | Whole plant | [14] |
| 32  | Serjanic acid                                  | *Cecropia telenitida* Cuatrec. | Roots         | [16] |
| 33  | Spergulagenic acid A                           | *Cecropia telenitida* Cuatrec. | Roots         | [16] |
| No. | Name                                | Plant source                      | Organ       | Ref. |
|-----|-------------------------------------|-----------------------------------|-------------|------|
| 34  | Tormentic acid                      | *Cecropia schreberiana* Miq.      | Leaves      | [9]  |
|     |                                     | *Debregeasia salicifolia* (D.Don) | Whole plant | [14] |
|     |                                     | *Boehmeria nivea* L.               | Roots       | [17] |
| 35  | 3β-(E)-cinnamoyl-oxy-19-α-hydroxy-urs-12-ene | *Debregeasia salicifolia* (D.Don) | Whole plant | [14] |
| 36  | Ursolic acid                        | *Debregeasia salicifolia* (D.Don) | Whole plant | [14] |
| 37  | Uvaol                               | *Debregeasia salicifolia* (D.Don) | Whole plant | [14] |
| 38  | Yarumic acid                        | *Cecropia telenitida Cuatrec.*    | Roots       | [16] |

**II-Sterols**

| No. | Name                             | Plant source                      | Organ       | Ref. |
|-----|----------------------------------|-----------------------------------|-------------|------|
| 39  | Campesterol                      | *Urtica dioica* L.                | Roots       | [21] |
|     |                                  | *Girardinia heterophylla* Decne.  |             |      |
| 40  | Cholesterol                      | *Urtica pilulifera* L.            | Leaves      | [22] |
| 41  | 4,22-Cholestadien-3-one          | *Cecropia obtusifolia* Bertol.    | Leaves      | [7]  |
| 42  | 4-Cholestene-3,24-dione          | *Cecropia obtusifolia* Bertol.    | Leaves      | [7]  |
| 43  | 24R-Ethyl-5α-cholestan-3β,6α-diol| *Urtica dioica* L.                | Roots       | [24] |
| 44  | 7β-Hydroxy sitosterol            | *Urtica dioica* L.                | Roots       | [24] |
| 45  | β-Sitosterol                     | *Boehmeria nivea* L.              | Leaves      | [25] |
|     |                                  | *Urtica fissa* E. Pritz.          | Roots       | [26] |
|     |                                  | *Forsskaoala tenacissina* L.      | Aerial parts | [18] |
|     |                                  | *Urtica dioica* L.                | Whole plant | [10] |
|     |                                  | *Forsskaoala tenacissina* L.      | Whole plant | [11] |
|     |                                  | *Urtica dioica* L.                | Roots       | [24] |
|     |                                  | *Urtica pilulifera* L.            | Herbs       | [23] |
|     |                                  | *Girardinia heterophylla* Decne.  | Roots       | [27] |
|     |                                  | *Girardinia heterophylla* Decne.  | Leaves      | [22] |
| 46  | 7α-Hydroxy sitosterol-3-O-β-D-glucopyranoside | *Urtica dioica* L. | Roots | [24] |
| 47  | 7β-Hydroxy-sitosterol-3-O-β-D-glucopyranoside | *Urtica dioica* L. | Roots | [24] |
| 48  | 6′-O-Palmitoyl-sitosterol-3-O-β-D-glucopyranoside | *Urtica dioica* L. | Roots | [24] |
| 49  | β-Sitosterol-3-O-β-D-glucopyranoside | *Urtica fissa* E. Pritz. | Roots | [26] |
|     |                                  | *Forsskaoala tenacissina* L.      | Aerial parts | [18] |
|     |                                  | *Urtica dioica* L.                | Roots       | [24] |
|     |                                  | *Urtica pilulifera* L.            | Herbs       | [23] |
| 50  | Stigmasterol-3-O-β-D-galactoside  | *Urtica pilulifera* L.            | Herbs       | [23] |
| 51  | Stigmasterol-3-O-β-D-glucoeryranoside | *Urtica fissa* E. Pritz. | Roots | [26] |
|     |                                  | *Urtica pilulifera* L.            | Herb        | [23] |
| 52  | γ-Sitosterol                      | *Girardinia heterophylla* Decne.  | Roots       | [22] |
| 53  | α-Spinasterol                     | *Urtica fissa* E. Pritz.          | Roots       | [26] |

**III-Flavonoids**

| No. | Name                                      | Plant source                      | Organ       | Ref. |
|-----|-------------------------------------------|-----------------------------------|-------------|------|
| 54  | Afzelin                                   | *Urtica cannabina* L.             | Fruits      | [28] |
| 55  | Apigenin 6,8-di-C-β-D-glucopyranoside     | *Urtica cannabina* L.             | Leaves      | [26] |
|     |                                           | *Urtica laetevirens* Maxim.       | Aerial parts | [29] |
| 56  | Apigenin-7-O-glucoside                    | *Pilea microphylla* L.            | Leaves      | [30] |
| 57  | Apigenin-7-O-rutinoside                   | *Pilea microphylla* L.            | Whole plant | [30] |
| 58  | Astragalin                                 | *Urtica dioica* L.                | Seeds       | [26] |
|     |                                           | *Urtica cannabina* L.             | Fruits      | [28] |
| 59  | Catechin                                  | *Cecropia schreberiana* Miq.      | Leaves      | [9]  |
| 60  | Chalcone-6'-hydroxy-2',3,4-tri-methoxy-4'-O-β-D-glucopyranoside | *Boehmeria rugulosa* Wedd. | Leaves | [31] |
### Table 1: Isolated compounds from family "Urticaceae" (cont.)

| No. | Name                                      | Plant source                  | Organ       | Ref.  |
|-----|-------------------------------------------|-------------------------------|-------------|-------|
| 61  | Cinchonain Ia                            | Cecropia schreberiana Miq.   | Leaves     | [9]   |
| 62  | Cinchonain Ib                            | Cecropia schreberiana Miq.   | Leaves     | [9]   |
| 63  | Epicatechin                               | Boehmeria nivea L.            | Leaves     | [32]  |
|     |                                            | Cecropia schreberiana Miq.   | Leaves     | [9]   |
| 64  | Epicatechin gallate                       | Boehmeria nivea L.            | Leaves     | [32]  |
| 65  | (-)-Epiafzelechin-(-)-epicatechin-(4,8)-dimer | Boehmeria tricuspis Hance. | Roots      | [32]  |
| 66  | (-)-Epicatechin-(-)-epicatechin-(4,8)-dimer | Boehmeria tricuspis Hance. | Roots      | [32]  |
| 67  | Isoorientin                               | Cecropia schreberiana Miq.   | Leaves     | [9]   |
| 68  | Isoquercitrin                             | Urtica cannabin L.            | Fruits     | [28]  |
| 69  | Isovitexin                                | Urtica cannabin L.            | Fruits     | [28]  |
|     |                                            | Phenax angustifolius Wedd.    | Leaves     | [33]  |
| 70  | Isorhamnetin                              | Urtica dioica L.              | Seeds      | [26]  |
| 71  | Kaempferol                                | Urtica dioica L.              | Seeds      | [26]  |
| 72  | Luteolin                                  | Urtica artichocaulis Hand.-Mazz. | Aerial parts | [26] |
|     |                                            | Urtica dioica L.              | Aerial parts | [20] |
| 73  | Luteolin-7-O-neohesperidoside             | Urtica laetevires Maxim.      | Aerial parts | [29] |
| 74  | Luteolin-7-O-β-D-glucopyranoside          | Urtica laetevires Maxim.      | Aerial parts | [29] |
| 75  | 5-Methoxy-4′-hydroxy-2′,2″-di methylpyrano (3′,4″,7,8) isoflavone | Pouzolzia indica L.          | Leaves     | [34]  |
| 76  | 5-Methoxy-luteolin-7-O-β-D-glucopyranoside | Urtica laetevires Maxim.      | Aerial parts | [29] |
| 77  | Procyanidins B2                           | Cecropia schreberiana Miq.   | Leaves     | [9]   |
| 78  | Procyanidins B5                           | Cecropia schreberiana Miq.   | Leaves     | [9]   |
| 79  | Quercetin                                 | Urtica artichocaulis Hand.-Mazz. | Aerial parts | [26] |
|     |                                            | Urtica cannabin L.            | Fruits     | [28]  |
|     |                                            | Boehmeria rugulosa Wedd.      | Leaves     | [31]  |
|     |                                            | Urtica dioica L.              | Aerial parts | [20] |
| 80  | Quercetin-3-O-α-L-rhamnopyranoside        | Phenax angustifolius Wedd.    | Leaves     | [33]  |
| 81  | Quercetin-7-O-β-D-glucopyranoside         | Boehmeria rugulosa Wedd.      | Leaves     | [31]  |
| 82  | Rutin                                     | Boehmeria nivea L.            | Leaves     | [25]  |
|     |                                            | Urtica artichocaulis Hand.-Mazz. | Aerial parts | [26] |
|     |                                            | Boehmeria nivea L.            | Aerial parts | [29] |
|     |                                            | Urtica laetevires Maxim.      | Aerial parts | [29] |
| 83  | Scutellarein-7-O-α-L-rhamnoside           | Urtica cannabin L.            | Leaves     | [26]  |
| 84  | 3′,4′,5,6-Tetrahydroxy-7-O-[β-D-glucopyranosyl-(1→6)]-β-D-glucopyranosyl-(1→6)-β-D-glucopyranosyl-(1→3)-α-L-rhamno-pyranoside] isoflavone | Boehmeria rugulosa Wedd.    | Leaves     | [31]  |
| 85  | 3′,4′,5,6-Tetrahydroxy-7-O-[β-D-gluco-pyranosyl-(1→3)-α-L-hamno-pyranoside] isoflavone | Boehmeria rugulosa Wedd.    | Leaves     | [31]  |
| 86  | 2,4,4″-Trihydroxy chalcone                | Boehmeria nivea L.            | Roots      | [17]  |
| 87  | Vitexin                                   | Cecropia schreberiana Miq.   | Leaves     | [9]   |
|     |                                            | Phenax angustifolius Wedd.    | Leaves     | [33]  |

**IV-Lignans**

| No. | Name | Plant source | Organ         | Ref.  |
|-----|------|--------------|---------------|-------|
| 88  | Citrusin A | Pilea cavalieri Levl. | Whole plant | [35] |
| 89  | Citrusin B | Pilea cavalieri Levl. | Whole plant | [35] |
### Table 1: Isolated compounds from family "Urticaceae" (cont.)

| No. | Name                                                                 | Plant source                      | Organ      | Ref. |
|-----|----------------------------------------------------------------------|-----------------------------------|------------|------|
| 90  | Cyclo-olivil-9-O-β-glucopyranoside                                   | *Urtica triangularis* Hand-Mass.  | Roots      | [36] |
| 91  | Dehydrodiconiferyl alcohol                                          | *Urtica dioica* L.                | Roots      | [37] |
| 92  | Dehydrodiconiferyl alcohol-4-O-β-D-glucopyranoside                  | *Pilea cavaleriei* Levl.          | Whole plant| [35] |
| 93  | Dihydrodiconiferyl alcohol-4-O-β-D-glucopyranoside                  | *Pilea cavaleriei* Levl.          | Whole plant| [35] |
| 94  | 3,4-Divanyll tetrahydrofuran                                        | *Urtica dioica* L.                | Roots      | [37] |
| 95  | 2-Hydroxy-2-(3',4' dihydroxyphenyl) methyl-3-(3',4'-dimethoxy phenyl) methyl-γ-butyro-lactone (Phenaxo-lactone 1) | *Phenax angustifolius* Wedd.     | Leaves     | [33] |
| 96  | 2-Hydroxy-2-(4-O-β-D-gluco-pyranosyl-3'-hydroxyphenyl) methyl-3-(3',4'-dimethoxy phenyl) methyl-γ-butyro-lactone(Phenaxolactone 2) | *Phenax angustifolius* Wedd.     | Leaves     | [33] |
| 97  | Isolariciresinol-4-O-β-D-glucopyranoside                             | *Pilea cavaleriei* Levl.          | Whole plant| [35] |
| 98  | Lariciresinol-4-O-β-D-glucopyranoside                                | *Pilea cavaleriei* Levl.          | Whole plant| [35] |
| 99  | (-)-4-Methoxy-8’-acetyl olivil                                     | *Urtica triangularis* Hand-Mass.  | Roots      | [36] |
| 100 | (+)-4-Methoxy-8’-acetololivil 4-O-α-arabinopyranosyl-(1→6)-β-gluco-pyranoside | *Urtica triangularis* Hand-Mass.  | Roots      | [36] |
| 101 | (+)-Neo-olivil                                                      | *Urtica dioica* L.                | Roots      | [37] |
| 102 | (-)-Olivil-9-O-β-glucopyranoside                                    | *Urtica triangularis* Hand-Mass.  | Roots      | [36] |
| 103 | Phenaxolactone 4                                                    | *Phenax rugosus* Wedd.            | Leaves     | [38] |
| 104 | Phenaxolactone 5                                                    | *Phenax rugosus* Wedd.            | Leaves     | [38] |
| 105 | Pinoresinol                                                         | *Urtica dioica* L.                | Herbs      | [26] |
| 106 | Pouzolignan B                                                       | *Pouzolzia zeylanica* L.          | Aerial parts| [39] |
| 107 | Pouzolignan F                                                       | *Pouzolzia zeylanica* L.          | Aerial parts| [39] |
| 108 | Pouzolignan G                                                       | *Pouzolzia zeylanica* L.          | Aerial parts| [39] |
| 109 | Pouzolignan H                                                       | *Pouzolzia zeylanica* L.          | Aerial parts| [39] |
| 110 | Pouzolignan I                                                       | *Pouzolzia zeylanica* L.          | Aerial parts| [39] |
| 111 | Pouzolignan J                                                       | *Pouzolzia zeylanica* L.          | Aerial parts| [39] |
| 112 | (-)-Secoiso-lariciresinol                                           | *Urtica dioica* L.                | Roots      | [37] |
| 113 | (-)7'S,8'R,8'S'R Lariciresinol-9-O-α-L rhannopyranosyl (1→2)-β-D-glucopyranoside | *Pilea cavaleriei* Levl.          | Whole plant| [35] |

#### V-Sesquiterpenes

| No. | Name                                                                 | Plant source                      | Organ      | Ref. |
|-----|----------------------------------------------------------------------|-----------------------------------|------------|------|
| 114 | (1E,4R,5R,8R)-8-O-[(E)-p-Coumar-oyl]-4,5-epoxy-humula-1(10)-en-8-ol | *Pilea cavaleriei* Levl.          | Aerial parts| [40] |
| 115 | (1E,4R,5R,8R)-8-O-[(Z)-p-Coumar-oyl]-4,5-epoxy-humula-1(10)-en-8-ol | *Pilea cavaleriei* Levl.          | Aerial parts| [40] |
| 116 | (1E,5E,8R)-8-O-[(E)-p-Coumaroyl] humula-1(10),4(S)-dien-8-ol         | *Pilea cavaleriei* Levl.          | Aerial parts| [40] |
| 117 | (1E,5E,8R)-8-O-[(Z)-p-Coumaroyl] humula-1(10),4(S)-dien-8-ol          | *Pilea cavaleriei* Levl.          | Aerial parts| [40] |
| 118 | (1E,5E,8R)-Humula-1(10),4(5)-dien-8-ol                               | *Pilea cavaleriei* Levl.          | Aerial parts| [40] |
| 119 | (1E,5R,8R)-5-Hydroxyhumula-1(10),4(15)-dien-8-ol                     | *Pilea cavaleriei* Levl.          | Aerial parts| [40] |
| 120 | (1E,5R,8R)-8-O-[(E)-p-Coumaroyl]-5-hydroperoxy humula-1(10),4(15)-dien-8-ol | *Pilea cavaleriei* Levl.          | Aerial parts| [40] |
| No. | Name                                                                 | Plant source                   | Organ          | Ref. |
|-----|----------------------------------------------------------------------|--------------------------------|----------------|------|
| 121 | (1E,5R,8R)-8-O-[(E)-p-Coumaroyl]-5-hydroxyhumul-1(10),4-(15)-dien-8-ol | *Pilea cavaleriei* Levl.       | Aerial parts   | [40] |
| 122 | (1E,5R,8R)-8-O-[(Z)-p-Coumaroyl]-5-hydroperoxyhumul-1(10),4-(15)-dien-8-ol | *Pilea cavaleriei* Levl.       | Aerial parts   | [40] |
| 123 | (1E,5R,8R)-8-O-[(Z)-p-Coumaroyl]-5-hydroxyhumul-1(10),4-(15)-dien-8-ol | *Pilea cavaleriei* Levl.       | Aerial parts   | [40] |
| 124 | (1R,4E,8R,10R)-8-O-[(E)-p-Coumar-oyl]-1,10-epoxyhumul-4(5)-en-8-ol    | *Pilea cavaleriei* Levl.       | Aerial parts   | [40] |
| 125 | (1R,4E,8R,10R)-8-O-[(Z)-p-Coumar-oyl]-1,10-epoxyhumul-4(5)-en-8-ol    | *Pilea cavaleriei* Levl.       | Aerial parts   | [40] |
| 126 | (1S,4E,8R,10S)-8-O-[(E)-p-Coumar-oyl]-1,10-epoxyhumul-4(5)-en-8-ol    | *Pilea cavaleriei* Levl.       | Aerial parts   | [40] |
| 127 | 1-O-p-Coumaroyl-copaborneol                                          | *Pilea cavaleriei* Levl.       | Whole plant    | [41] |
| 128 | 8-O-(3-Nitro-p-coumaroyl)-1(10)E,4(15)-humuladien-5,8,8-diol           | *Pilea cavaleriei* Levl.       | Whole plant    | [41] |
| 129 | 8-O-(p-Coumaroyl)-5β-hydroperoxy-1(10)E,4(15)-humuladien-8,8-diol     | *Pilea cavaleriei* Levl.       | Whole plant    | [41] |
| 130 | 8-O-(p-Coumaroyl)-1(10)E,4(5)E-humuladien-8-ol                         | *Pilea cavaleriei* Levl.       | Whole plant    | [41] |
| 131 | 8-p-Coumaroyl-α-santalene                                              | *Pilea cavaleriei* Levl.       | Whole plant    | [42] |
| 132 | 8-β-p-Coumaroyl oplopanone                                             | *Pilea cavaleriei* Levl.       | Whole plant    | [42] |

**VII-Simple phenolic compounds**

| No. | Name                  | Plant source                  | Organ          | Ref. |
|-----|-----------------------|-------------------------------|----------------|------|
| 143 | Caffeic acid          | *Urtica arthchoracalis* Hand.-Mazz. | Aerial parts | [26] |
| 144 | 3,4-Dimethoxy-acetophenone | *Urtica dioica* L.             | Roots          | [50] |
| 145 | 2,6-Dimethoxy hydroquinone | *Urtica dioica* L.             | Fruits         | [49] |
| 146 | Diocanol              | *Urtica dioica* L.             | Roots          | [48] |
| 147 | Ferulic acid          | *Urtica dioica* L.             | Leaves         | [10] |
| 148 | Gallic acid           | *Urtica dioica* L.             | Fruits         | [49] |
| 149 | Gentisic acid         | *Urtica dioica* L.             | Roots          | [48] |
| 150 | Homovanillic acid     | *Urtica dioica* L.             | Sources        | [26] |
| 151 | Homovanillyl alcohol  | *Urtica dioica* L.             | Whole plant    | [51] |
| No. | Name                                                                 | Plant source              | Organ    | Ref. |
|-----|----------------------------------------------------------------------|---------------------------|----------|------|
| 152 | 1-(4-Hydroxy-3-methoxy phenyl)- propane-1,2-diol                     | *Urtica dioica* L.        | Roots    | [48] |
| 153 | 1-Hydroxy-1-(4-hydroxy-3-methoxy phenyl) propan-2-one                | *Urtica dioica* L.        | Roots    | [48] |
| 154 | 1-Hydroxy-1-(4-hydroxyphenyl)propan-2-one                            | *Urtica dioica* L.        | Roots    | [48] |
| 155 | 2-Hydroxy cinnamic acid                                             | *Urtica dioica* L.        | Stems    | [50] |
| 156 | 2-Hydroxy-imino-3-phenyl propionic acid                              | *Forsskaolea tenacissima* L. | Aerial parts | [18] |
| 157 | 2-Hydroxy-1-(4-hydroxy-3-methoxy phenyl) propan-1-one                | *Urtica dioica* L.        | Roots    | [48] |
| 158 | 4-Hydroxy-cinnamic acid                                             | *Urtica dioica* L.        | Stems    | [50] |
| 159 | 4-Hydroxy-3-methoxybenzaldehyde                                     | *Urtica dioica* L.        | Roots    | [48] |
| 160 | 4-Hydroxy-3-methylaceto-phenone                                     | *Urtica dioica* L.        | Roots    | [48] |
| 161 | 4-Hydroxybenzyl alcohol                                             | *Urtica dioica* L.        | Roots    | [48] |
| 162 | 4-Hydroxyphen-ethyl alcohol                                         | *Urtica dioica* L.        | Roots    | [48] |
| 163 | (E)-4-(3-Hydroxy-prop-1-en-1-yl)-2-methoxy phenol                    | *Urtica dioica* L.        | Roots    | [48] |
| 164 | 3-Methoxy-acetophenone                                              | *Cecropia obtusifolia* Bertol. | Leaves  | [7]  |
| 165 | 2-Methoxy-4-vinyl phenol                                             | *Cecropia obtusifolia* Bertol. | Leaves  | [7]  |
| 166 | 2-Methyl-benzaldehyde                                               | *Cecropia obtusifolia* Bertol. | Leaves  | [7]  |
| 167 | Protocatechueic acid                                                | *Urtica dioica* L.        | Leaves   | [26] |
| 168 | Protocatechueic aldehyde                                            | *Urtica arthichocaulis* Hand.-Mazz. | Aerial parts | [26] |
| 169 | Salicylic acid                                                       | *Urtica arthichocaulis* Hand.-Mazz. | Aerial parts | [26] |
| 170 | Salicylic alcohol                                                    | *Urtica dioica* L.        | Roots    | [48] |
| 171 | Syringic acid                                                       | *Urtica dioica* L.        | Leaves   | [50] |
| 172 | Vanillic acid                                                       | *Cecropia obtusifolia* Bertol. | Leaves  | [7]  |

**VIII-Miscellaneous compounds**

| No. | Name                   | Plant source              | Organ    | Ref. |
|-----|------------------------|---------------------------|----------|------|
| 173 | Adenine                | *Boehmeria holosericea* Blume | Fruits  | [49] |
| 174 | Adenosine              | *Boehmeria holosericea* Blume | Fruits  | [49] |
| 175 | Aesculetin             | *Urtica dioica* L.        | Leaves   | [26] |
| 176 | Aloe-emodin            | *Cecropia obtusifolia* Bertol. | Leaves | [7]  |
| 177 | Benzyl-β-D-glucopyranoside | *Boehmeria holosericea* Blume | Fruits  | [49] |
| 178 | (+)-Blumenol A         | *Urtica cannabina* L.     | Fruits   | [28] |
| 179 | (+)-Dehydrovomi-foliol | *Urtica cannabina* L.     | Fruits   | [28] |
| 180 | Chlorogenic acid       | *Urtica arthichocaulis* Hand.-Mazz. | Aerial parts | [26] |
|     |                        | *Pipturus albidus* Hook. & Arn. | Leaves | [52] |
| 181 | Chrysophanol           | *Cecropia obtusifolia* Bertol. | Leaves  | [7]  |
| 182 | 2,3-Dihydro-benzofuran | *Cecropia obtusifolia* Bertol. | Leaves  | [7]  |
| 183 | Emodin-8-O-β-glucoside | *Boehmeria nivea* L.      | Leaves   | [32] |
| 184 | Kiwiiososide           | *Boehmeria nivea* L.      | Leaves   | [32] |
| 185 | Laportomide A          | *Laportea ovalifolia* Schum. | Leaves  | [53] |
### Table 1: Isolated compounds from family "Urticaceae" (cont.)

| No. | Name                                    | Plant source                          | Organ      | Ref.   |
|-----|-----------------------------------------|---------------------------------------|------------|--------|
| 186 | Laportoside A                           | Laportea ovalifolia Schum.            | Leaves    | [53]   |
| 187 | Forskamide                              | Forskkoela tenacissina L.             | Aerial parts | [2]    |
| 188 | Pellioniareside                         | Pellionia repens Lour.                | Whole plant | [54]   |
| 189 | 3-O-Caffeoyl quinic acid                 | Pilea microphylla L.                  | Whole plant | [30]   |
| 190 | 1-Methylene-1H-indene                   | Pilea trinervia L.                    | Leaves    | [55]   |
| 191 | Oreolactone                             | Oreocnide frutescens Thunb.           | Rhizomes   | [56]   |
| 192 | Physcion                                | Cecropia obtusifolia Bertol.          | Leaves    | [7]    |
| 193 | Pyrimidinedione                         | Boehmeria nivea L.                    | Leaves    | [25]   |
| 194 | Polydatin                               | Boehmeria nivea L.                    | Leaves    | [32]   |
| 195 | Quinic acid                             | Urtica dioica L.                      | Leaves    | [26]   |
| 196 | Rhein                                   | Cecropia obtusifolia Bertol.          | Leaves    | [7]    |
| 197 | Scopoletin                              | Urtica dioica L.                      | Leaves    | [26]   |
| 198 | Uracil                                  | Urtica dioica L.                      | Roots     | [51]   |
| 199 | Uridine                                 | Boehmeria holosericea Blume           | Fruits    | [49]   |
| 200 | (-)-Loliolide                           | Boehmeria nivea L.                    | Leaves    | [25]   |

![Figure 1: Isolated compounds from family "Urticaceae".](image-url)
Figure 1: Isolated compounds from family "Urticaceae" (cont.).
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Figure 1: Isolated compounds from family "Urticaceae" (cont.).
Genus Pilea showed 31 isolated compounds, classified as (one triterpene, 2 flavonoids, 7 lignans, 19 sesquiterpenes and 2 miscellaneous compounds).

Genus Forsskaolea showed 8 isolated compounds, classified as (4 triterpenes, 2 sterols, one simple phenolic and one miscellaneous compound).

Genus Debregeasia showed 8 isolated triterpene compounds.

Genus Pouzolzia showed 7 isolated compounds, classified as (one flavonoid and 6 lignans).

Other genera showed minor isolated compounds.

### 2.2. Biological activities

On reviewing the current available literature, many researchers studied various biological activities of many plants of the family Urticaceae. These biological activities included *viz.*, cytotoxic, antimicrobial (bacterial, antifungal and antiviral) anti-inflammatory, antidiabetic, anti-benign prostatic hyperplasia, hepatoprotective, antioxidant as well as wound healing.

#### Results of biological review (Table 2 and Figure 3) showed the following:

1- Genus Urtica is the major genus in family Urticaceae and showed 28 published biological activities, classified as (5 cytotoxicity, one antimicrobial, 5 anti-inflammatory, 5 antidiabetic, 4 anti-benign prostatic hyperplasia, 3 hepatoprotective and 5 antioxidant).

2- Genus Forsskaolea showed 13 published biological activities, classified as (3 cytotoxicity, 4 antimicrobial, one antidiabetic, one hepatoprotective, 3 antioxidant and one wound healing).

3- Genus Boehmeria showed 8 published biological activities, classified as (4 cytotoxicity, 2 antimicrobial, one anti-inflammatory and one antidiabetic).

4- Genus Cecropia showed 8 published biological activities, classified as (one cytotoxicity, one antimicrobial, 4 anti-inflammatory, one antidiabetic and one antioxidant).

5- Genus Urera showed 6 published biological activities, classified as (one cytotoxicity, 2 antimicrobial and 3 anti-inflammatory).

6- Genus Laportea showed 6 published biological activities, classified as (one cytotoxicity, 3 antimicrobial, one antidiabetic and one antioxidant).

#### Table 2: Biological activities of family "Urticaceae".

| No. | Plant source          | Organ          | Extract/Fraction/Compound | Activity/Result                                                                 | Ref.   |
|-----|-----------------------|----------------|----------------------------|--------------------------------------------------------------------------------|--------|
| 1   | *Forsskaolea tenacissima* L. | Aerial parts | Forsskamide | It displayed a moderate cytotoxic activity against human colorectal carcinoma cell line (HCT-116) with IC$_{50}$ 33.25 μM in comparison with 5-fluorouracil IC$_{50}$ 26.42 μM using (MTT) method. | [2]     |
| 2   | *Forsskaolea tenacissima* L. | Whole plant | Hexane, dichloromethane, ethyl acetate and methanol extracts | They showed very weak activity towards lymphoblastic leukemia CCRF-CEM tumor cells at a fixed concentration of 10 mg/mL as determined by the resazurin reduction assay. | [57]   |
| 3   | *Urtica dioica* L.     | Leaves        | Aqueous extract          | It showed inhibition activity for Adenosine deaminase (ADA) enzyme in cancerous gastric tissues significantly but does not affect the enzyme in colon tissue using cancerous and noncancerous human gastric and colon tissues removed by surgical operations. | [58]   |
| 4   | *Forsskaolea tenacissima* L. | Aerial parts | 2-Hydroxy imino 3-phenyl propionic acid | It showed weak activity against normal cell line (Vero) and cancer cell lines (MCF-7, Caco-2 and HepG-2) by MTT Assay. | [18]   |
| No. | Plant source          | Organ     | Extract/Fraction/Compound       | Activity/Result                                                                                                                                                                                                 | Ref.  |
|-----|-----------------------|-----------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 5   | *Urtica dioica* L.    | Leaves    | Aqueous extract                 | It showed cytotoxic activity in LNCaP treated prostate carcinoma cell line by MTT Assay.                                                                                                                    | [26]  |
| 6   | *Urtica pilulifera* L.| Leaves    | Methanol extract                | It showed a maximum cytotoxic activity (IC_{50}=63 μg/mL), it inhibited the proliferation of (MCF-7) and it increase protein concentration and reduces the lipids in lipidemic liver and remolds phospholipids compositions using the MTT assay. | [26]  |
| 7   | *Urtica dioica* L.    | Roots     | Aqueous extract                 | It showed cytotoxic activity by affecting on proliferation reduction of myelogenous leukemia cell line by activating the apoptotic pathway against acute myelogenous leukemia cell line using the MTT assay. | [26]  |
| 8   | *Urtica pilulifera* L.| Aerial parts | Methanol extract               | It showed highest cytotoxicity against breast cancer, about 85% of the cells were found dead at the concentration of 500 μg/mL using the MTT assay.                                                          | [26]  |
| 9   | *Cecropia lyrafiloba* Miq. | Roots | Euscaphic, 2α-tormentic and 3β-acetyltormentic acid | It showed cytotoxic activity against leukemia cell line K562 and multidrug resistant leukemia cell line Lucena-1, euscaphic (76.71a/83.79b μM), 2α-tormentic (89.36a / 80.25b μM), 3β-acetyltormentic acids (56.61a/72.87b μM) using the MTT assay. | [12]  |
| 10  | *Boehmeria siamensis* L. | Whole plant | Bohmeriasin A and B | Bohmeriasin A possesses cytotoxic activity against 12 cell lines from six panels of cancer including lung cancer, colon cancer, breast cancer, prostate cancer, kidney cancer and leukemia between 0.2 and 100 μg/mL, whereas boehmeriasin B showed lower activity. | [43]  |
| 11  | *Boehmeria siamensis* L. | Whole plant | Bohmeriasin A       | It inhibited the proliferation of breast cancer cell MDA-MB-231 via the G1 phase cell cycle arrest and differentiation induction, it considered as candidate chemotherapeutic agent for breast cancer.                       | [59]  |
| 12  | *Laportea crenulata* Gaud. | Roots | Total extract and 2α,3β,21β,23, 28-penta-hydroxy-12-oleanene | They showed cytotoxic activities observed by brine shrimp bioassay and IC_{50} of the compound was found to be 27.54 μg/mL.                                                                                       | [60]  |
| 13  | *Pilea cavaleriei* Levl. | Whole plant | 8-O-(p-Coumaryloyl)-1(10)E, 4(5)E-humuladien-8-ol | It exhibited weak cytotoxic activity against proliferation of seven human tumor cell lines, K562 (IC_{50}=12.01 μg/mL), AGZY (IC_{50}=27.82 μg/mL) and A549 (IC_{50}=25.60 μg/mL) cell lines using the MTT assay.  | [41]  |
| 14  | *Boehmeria pannosa* Nakai & Satake | Roots | Methanol extract, (-)-cryptopleurine and (-)-(15R)-hydroxy-cryptopleurine | They inhibited the hypoxia-induced expression of a reporter gene under the control of a hypoxiareponse element (HRE) with IC_{50} values of 8.7 and 48.1 nM, respectively, which could be an important target of cancer chemotherapy using a HIF-1-mediated reporter gene assay. | [47]  |
| 15  | *Urera baccifera* L.  | Roots and Leaves | Total hydro-ethanol extract and its fractions (chloroform, ethyl acetate and n-butanol) | They showed weak cytotoxic activity against Herpes virus type 1, using the MTT assay.                                                                                                                          | [61]  |
| 16  | *Pilea mongolica* Wedd. | Aerial parts | Epi-oleanolic acid and oxo-oleanolic acid | They exhibited cytotoxicity against cultured human tumor cell lines, non-small cell lung adenocarcinoma, ovarian, skin melanoma, CNS and colon.                                                                       | [19]  |
| No. | Plant source | Organ | Extract/Fraction/Compound | Activity/Result | Ref. |
|-----|--------------|-------|---------------------------|-----------------|------|
| 17  | *Pouzolzia indica* L. | Aerial parts | Methanol extract | It inhibited the acute promyelocytic leukemia cell lines NB4 and HT93A with the IC<sub>50</sub> values of 28.5 and 49.8 μg/mL, respectively using the MTT assay. | [62] |
| 18  | *Boehmeria cylindrica* L. | Whole plant | Ethanol extract and cryptopleurine alkaloid | They showed cytotoxic action against Eagle's 9KB carcinoma of the nasopharynx in cell culture. | [63] |
| 19  | *Pipturus arborescens* C.B. Rob. | Leaves | 1-Hexacosene and a terpene | They exhibited moderate toxicity towards the brine shrimp bioassay. | [64] |
| 20  | *Pouzolzia indica* L. | Whole plant | 5-Methoxy-4'-hydroxy-2'',2''-dimethyl pyrano (3'',3'',7,8) isoflavone | It showed moderate cytotoxic activity, LC<sub>50</sub> of the compound was found to be 24.92 μg/mL against brine shrimp bioassay. | [34] |

**II-Antimicrobial activity**

**IIA-Antibacterial and antifungal activities**

| No. | Plant source | Organ | Extract/Fraction/Compound | Activity/Result | Ref. |
|-----|--------------|-------|---------------------------|-----------------|------|
| 21  | *Dendrocnide sinuata* (Blume) Chew. | Leaves | Aqueous extract | It showed antimicrobial activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Micrococcus luteus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Enterobacter aerogenes* and *Candida albicans* using agar diffusion method. | [65] |
| 22  | *Laportea ovalifolia* (Schum.) Chew | Leaves | Methanol extract | It showed antimicrobial activity against *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis*, *Enterococcus faecalis*, *Streptococcus pyogenes*, *Salmonella typhimurium*, *Klebsiella pneumonia* with erythromycin and ciprofloxacin using microdilution technique. | [66] |
| 23  | *Dendrocnide microstigma* (Wedd.) Chew. | leaves | Ethanol extract | It showed antimicrobial activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Candida albicans*, *Aspergillus niger* and *Microsporum gypseum* by using agar diffusion assay and micro broth dilution. | [67] |
| 24  | *Elatostema repens* (Lour.) Hallier f. | Aerial parts | Ethanol extract | It showed antimicrobial activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Candida albicans*, *Aspergillus niger* and *Microsporum gypseum* by using agar diffusion assay and micro broth dilution. | [67] |
| 25  | *Villebrunea scabra* (Blume) Wedd. | Leaves and bark | Ethanol extract | It showed antimicrobial activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Candida albicans*, *Aspergillus niger* and *Microsporum gypseum* by using agar diffusion assay and micro broth dilution. | [67] |
| 26  | *Forsskaolea tenacissima* L. | Leaves | Ethanol, aqueous and n-hexane extracts | They showed antimicrobial activity against *Escherichia coli*, *Xanthomonas maltophilia*, *Bacillus subtilis*, *Clavibacter michiganense*, *Staphylococcus aureus*, *Aspergillus niger*, *Trichoderma reesi*, *Rhizopus stolonifer* and *Acronomium alternatum* using well diffusion method. | [68] |
| 27  | *Forsskaolea tenacissima* L. | Whole plant | Methanol extract | It showed antimicrobial activity against *Escherichia coli*, *Salmonella typhi*, *Pseudomonas aeruginosa*, *Providencia sp.*, *Proteus mirabilis*, *Shigella sonnei*, *Citrobacter sp.*, *Aspergillus fumigatus*, *Penicillium chrysogenum* and *Rhizopus sp.* using disc diffusion method. | [69] |
| No. | Plant source | Organ | Extract/Fraction/ Compound | Activity/Result | Ref. |
|-----|--------------|-------|-----------------------------|-----------------|------|
| 28  | *Forsskaolea tenacissima* L. | Aerial parts | Total methanol extract, n-hexane, dichloromethane, ethyl acetate and methanol fractions | Ethyl acetate fraction showed significant antimicrobial activity against both Gram-negative bacteria as *Escherichia coli* and *Pseudomonas aeruginosa* and Gram-positive bacteria as *Staphylococcus aureus* and *Bacillus subtilis* while, both the total extract and different fractions did not show antifungal activity against *Aspergillus niger* and *Candida albicans* using agar cup diffusion method. | [18] |
| 29  | *Pouzolzia indica* L. | Whole plant | 5-Methoxy-4′-hydroxy-2′,2″-dimethyl-pyran (3″,3″,7,8) isoflavone | It showed the minimum inhibitory concentration (MIC) to be 32 μg/mL against *Escherichia coli* using serial dilution technique. | [34] |
| 30  | *Debregeasia salicifolia* (D.Don) | Whole plant | 3β-(E)-cinnamoyl-oxy-19-α-hydroxy-urs-12-ene, 3β, 19α-dihydroxy-urs-12-ene and pomolic acid methyl ester | It exhibited significant activities against Gram-positive (*Bacillus subtilis, Staphylococcus aureus, Streptococcus pyogenes*) and Gram-negative (*Escherichia coli, Pseudomonas aeruginosa, Salmonella typhi, Shigella boydii*) bacteria using agar well diffusion method. | [14] |
| 31  | *Laportea crenulata* Gaud. | Roots | 2α,3β,21β,24β,28-penta-hydroxy-olean-12-ene | It showed significant activity against (*Bacillus subtilis, Streptococcus β-haemolyticus, Escherichia coli* and *Shigella dysenteriae*) bacteria and (*Aspergillus flavus, Aspergillus niger, Candida albicans* and *Rhizopus aurizae*) fungi using disc diffusion method. | [60] |
| 32  | *Laportea crenulata* Gaud. | Roots | Total extracts and 2α,3β,21β,23, 28-penta hydroxyl 12-oleane | They exhibited moderate antifungal activity against *Aspergillus flavus, Aspergillus niger, Candida albicans* and *Rhizopus aurizae* using disc diffusion method. | [70] |
| 33  | *Boehmeria rugulosa* Wedd. | Leaves | Ethanol extract and chalcone-6′-hydroxy-2',3,4,trimethoxy-4′-O-β-D-glucopyranoside, isoflavone-3′,4′,5,6-tetrahydroxy-7-O-[β-D-glucopyranosyl-(1→3)-α-L-rhamno-pyranoside] and isoflavone-3′,4′,5,6-tetrahydroxy-7-O-[β-D-glucopyranosyl-(1→6)-β-D-glucopyranosyl-(1→6)-β-D-glucopyranosyl-(1→3)-α-L-rhamnopyranoside] | They showed potent antimicrobial activity against two bacterial species (*Staphylococcus aureus* and *Streptococcus mutans*) and three fungus pathogens (*Microsporum gypseum, Microsporum canis* and *Trichophyton rubrum*) using disc diffusion method. | [31] |
| 34  | *Pouzolzia zeylanica* L. | Whole plant | Ethanol extract | It showed antibacterial activity against both Gram-positive and Gram-negative organisms such as *Bacillus subtilis, Bacillus megaterium, Staphylococcus aureus, pseudomonas aeruginosa, Escherichia coli, Shigella dysentariae, Salmonella typhi*, using agar cup plate method. | [71] |
| 35  | *Urera baccifera* L. | Roots and Leaves | Total hydro-ethanol extract and its fractions (chloroform, ethyl acetate and n-butanol) | They showed antimicrobial activity against *Aspergillus flavus, Candida parapsilosis, Candida tropicalis, Candida glabrata, Candida dublinskiensis, Candida albican, Saccharomyces cerevisiae, Cryptococcus neoformans, Cryptococcus gattii, Malassezia pach, Prototheca zopfii, Micrococcus sp., Proteus mirabilis, Klebsiella pneumoniae, Pseudomonas aeruginosa, Aeromonas sp., Enterococcus faecalis, Staphylococcus aureus, Staphylococcus agalactiae* and *Escherichia coli* using broth microdilution method. | [61] |
### Table 2: Biological activities of family "Urticaceae" (cont.)

| No. | Plant source                        | Organ          | Extract/Fraction/Compound | Activity/Result                                                                                                                                                                                                 | Ref.   |
|-----|-------------------------------------|----------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 36  | *Elatostema parasiticum* Blume.     | Aerial parts   | Total ethanol extract     | It exhibited antimicrobial activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Candida albicans*, *Aspergillus niger* and *Microsporum gypseum* using disc diffusion method. | [67]   |
| 37  | *Girardinia diversifolia* Link.    | Roots and Stems | Total methanol extract    | It showed antimicrobial activity against *Bacillus pumilus*, *Staphylococcus aureus*, *Escherichia coli*, *Aspergillus niger*, *Candida albicans* and *Saccharomyces cerevisiae* using disc diffusion method. | [72]   |
| 38  | *Urtica dioica* L.                  | Leaves         | Methanol extract and phenolic fraction of plant extract | They showed antimicrobial activity against *Escherichia coli*, *Salmonella enteridis*, *Staphylococcus aureus*, *Listeria monocytogenes*, *Pseudomonas putida* and *Bacillus cereus* using disk diffusion technique. | [73]   |

#### II-B Antiviral activity

| No. | Plant source                        | Organ          | Extract/Fraction/Compound | Activity/Result                                                                                          | Ref.   |
|-----|-------------------------------------|----------------|---------------------------|----------------------------------------------------------------------------------------------------------|--------|
| 39  | *Forsskaolea tenacissima* L.        | Aerial parts   | Total methanol extract, n-hexane, dichloromethane, ethyl acetate and methanol fractions | Total methanol extract and methanol fraction showed high antiviral activity against Herpes Simplex Virus Type-1 (HSV-1) by MTT cell viability test. | [18]   |
| 40  | *Cecropia glaziovii* Sneth.        | Leaves         | Aqueous extract and the C-glycosyl flavonoid enriched fraction | They showed antiviral activity against human herpes virus types 1 and 2 (HHV-1 and HHV-2) by plaque reduction assay. | [12]   |
| 41  | *Phenax angustifolius* Wedd. and *Phenax rugosus* Wedd. | Leaves | Phenaxolactones (1-5) and flavones (vitexin and isovitexin) | They showed antiviral activity against HIV-1 virus using virus infectivity assay method. | [38]   |
| 42  | *Boehmeria cylindrica* L.           | Whole plant    | Cryptopleurine             | It showed antiviral activity against herpesvirus hominis.                                               | [44]   |
| 43  | *Urera baccifera* L.               | Roots and Leaves | Total hydro-ethanol extract and its fractions (chloroform, ethyl acetate and n-butanol) | They showed antiviral activity against Herpes virus type 1 by MTT cell viability test.                  | [61]   |
| 44  | *Urtica dioica* L.                 | Whole plant    | Ethanol extract            | It showed antiviral activity against replication of *Autographa californica* nuclear polyhedrosis virus (AcNPV) grown in *Spodoptera frugiperda* cell culture. | [74]   |

#### III-Anti-inflammatory activity

| No. | Plant source                        | Organ          | Extract/Fraction/Compound | Activity/Result                                                                                                                                                                                                 | Ref.   |
|-----|-------------------------------------|----------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 45  | *Musanga cecropioides* R. Br.       | Leaves         | Ethanol extract            | It showed anti-inflammatory activity using carrageenan, histamine, serotonin and xylene-induced edema tests in rats.                                                                                        | [75]   |
| 46  | *Dendrocnide sinuata* (Blume) Chew. *Urtica dioica* L. | Roots | Aqueous extract | It exhibited anti-inflammatory activity with carrageenan-induced paw edema in rats.                                                                                                                         | [76]   |
| 47  | *Urtica dioica* L.                  | Seeds          | Ethanol extract            | It showed anti-inflammatory activity with inflammation induced by the toxic effects of fluoride.                                                                                                           | [77]   |
| 48  | *Urtica dioica* L.                  | Whole plant    | Methanol extract           | It exhibited anti-inflammatory activity with carrageenan-induced paw edema in rats.                                                                                                                         | [26]   |
| 49  | *Cecropia obtusifolia* Bertol.      | Leaves         | Vanillic acid, palmitic acid, stearic acid, rehin, phycsin, emodin, chrysophanol, aloemodin, stigmast-4-en-3-one, stigmasterol and β-sitosterol | These compounds exhibited anti-inflammatory activity by inhibition of vascular adhesion molecule 1 and intracellular adhesion molecule 1 expression in tumor necrosis factor-α (TNF-α)-stimulated human aortic endothelial cells (HAECs) by adhesion assay with the tetrazolium dye MTT [3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide]. | [7]    |
### Table 2: Biological activities of family "Urticaceae" (cont.)

| No. | Plant source                  | Organ          | Extract/Fraction/ Compound | Activity/Result                                                                 | Ref. |
|-----|-------------------------------|----------------|----------------------------|---------------------------------------------------------------------------------|------|
| 50  | *Cecropia pachystachya* Trecul. | Leaves         | Vitexin, rutin α-amyrin, oleoanolic acid, pomolic acid, ursolic acid and E-phytol | These compounds showed anti-inflammatory activity on lipopolysaccharide (LPS)-induced inflammatory responses with mouse peritoneal macrophages. | [7]  |
| 51  | *Cecropia obtusifolia* Bertol. | Leaves         | Aqueous extract            | It exhibited anti-inflammatory activity with carrageenan-induced paw edema in rats. | [12] |
| 52  | *Phenax rugosus* Wedd.        | Whole plant    | Aqueous extract            | It exhibited anti-inflammatory activity with TPA-induced mouse ear edema and carrageenan-induced paw edema in rats. | [78] |
| 53  | *Urera baccifera* L.          | Roots and Leaves | Total hydro-ethanol extract and its fractions (chloroform, ethyl acetate and n-butanol) | They exhibited no anti-inflammatory activity with topical application of root and leaf of the plant induced ear edema in rats. | [61] |
| 54  | *Cecropia telenitida* Cuatrec. | Roots          | Yarumic acid, serjaniac acid, spergulagenic acid A, 20-hydroxy-ursolic acid and goreishic acid I | They inhibited the secretion of the proinflammatory cytokines mediators using dendritic cell (DC) based assay method. | [16] |
| 55  | *Boehmeria caudata* Sw.       | Whole plant    | Crude ethanol extract      | It exhibited anti-inflammatory activity with croton oil-induced mouse ear edema model in rats. | [79] |
| 56  | *Urtica pilulifera* L.        | Seeds          | Petroleum ether extract    | It exhibited anti-inflammatory activity with carrageenan-induced paw edema in rats. | [80] |
| 57  | *Urera baccifera* L.          | Leaves         | Aqueous fraction           | They showed anti-inflammatory activity with carrageenan-induced paw edema in rats. | [81] |
| 58  | *Urtica leptophylla* Kunth. and *Urera baccifera* L. | Whole plant | Aqueous extract            | It exhibited anti-inflammatory activity with carrageenan-induced paw edema model in rats. | [81] |
| 59  | *Morus indica* L.             | Leaves         | Ethanol extract            | It showed anti-inflammatory activity with carrageenan-induced paw edema in rats. | [82] |
| 60  | *Urtica dioica* L.            | Leaves         | Methanol extract           | It exhibited anti-inflammatory activity with acetic acid-induced writhing formalin test and carrageenan-induced paw edema in rats. | [83] |
| 61  | *Sarcochlamys pulcherrima* G. | Leaves         | Methanol extract           | It showed anti-inflammatory activity by inhibiting heat-induced protein denaturation using *in vitro* anti-inflammatory test method. | [84] |

#### IV-Antidiabetic activity

| No. | Plant source                  | Organ          | Extract/Fraction/ Compound | Activity/Result                                                                 | Ref. |
|-----|-------------------------------|----------------|----------------------------|---------------------------------------------------------------------------------|------|
| 62  | *Girardinia heterophylla* Decne. | Leaves         | Petroleum ether, chloroform, ethanol, aqueous and extracts | Chloroform, ethanol, aqueous and extracts showed significant improvement in antidiabetic activity with alloxan induced diabetes in rats. | [85] |
| 63  | *Urtica dioica* L.            | Leaves         | Aqueous extract            | It exhibited antidiabetic activity with alloxan-induced diabetes in rats.        | [86] |
| 64  | *Urtica dioica* L.            | Leaves         | Hydro-methanol extract     | It exhibited antidiabetic activity with streptozotocin-induced diabetes in rats. | [26] |
| 65  | *Urtica pilulifera* L.        | Leaves         | Methanol extract           | It showed antidiabetic activity with alloxan-induced diabetes in rats.           | [26] |
| 66  | *Urtica dioica* L.            | Whole plant    | Aqueous extract            | It exhibited antidiabetic activity with streptozotocin-induced diabetes in rats. | [87] |
| 67  | *Cecropia obtusifolia* Bertol. | Leaves         | Phenolic acids, chlorogenic acid and isoorientin | These compounds showed antidiabetic effects by stimulating glucose uptake in both insulin-sensitive and insulin-resistant adipocytes without appreciable pro-adipogenic effects, which assayed on the adipogenesis and glucose uptake in murine adipocytes. | [7]  |
| 68  | *Laportea ovalifolia* Schum.   | Aerial parts   | Methanol and methylene chloride extracts | They exhibited antidiabetic activity with alloxan-induced diabetes in rats.       | [88] |
| No. | Plant source | Organ | Extract/Fraction/Compound | Activity/Result | Ref. |
|-----|--------------|-------|----------------------------|-----------------|------|
| 69  | *Boehmeria rugulosa* Wedd. | Leaves | Ethanol extract | It exhibited antidiabetic activity with alloxan-induced diabetes in mice. | [31] |
| 70  | *Urtica pilulifera* L. | Seeds | Total extract | It exhibited antidiabetic activity with streptozotocin induced diabetes in rats. | [89] |
| 71  | *Forsskaolea tenacissima* L. | Aerial parts | Total methanol extract and its different fractions | The ethyl acetate fraction showed a significant decrease in blood glucose level in comparison with glibenclamide as positive control with alloxan-induced diabetes in rats. | [90] |

**V-Anti-benign prostatic hyperplasia activity**

| No. | Plant source | Organ | Extract/Fraction/Compound | Activity/Result | Ref. |
|-----|--------------|-------|----------------------------|-----------------|------|
| 72  | *Urtica dioica* L. | Roots | \(n\)-Hexane, ether, ethyl acetate and \(n\)-butanol extracts | They inhibit the membrane Na\(^+\), K\(^+\) ATPase activity of the prostate which can finally suppress prostate-cell metabolism and growth. | [87] |
|     |              |       | Aqueous extract, methanol extract, agglutinin and stigmasta-4-en-3-one | They examined for their ability to modulate binding of sex hormone-binding globulin to its receptor on human prostatic membranes, which can preventing the benign prostatic hyperplasia. |     |
| 73  | *Urtica fissa* Pritz. | Stems and Roots | Aqueous extract | It inhibited benign prostatic hyperplasia in animal models using castrated rat prostate hyperplasia induced by testosterone propionate. | [91] |
| 74  | *Urtica fissa* Pritz. | Whole plant | Ethanol extract | It exhibited decrease in the density of lecithin corpuscle and increase the acid phosphatase level, the benign prostatic hyperplasia rats induced by testosterone propionate | [92] |
| 75  | *Urtica dioica* L. | Roots | Ethanol extract | It showed inhibition in benign prostatic hyperplasia using testosterone-induced prostatic hyperplasia in rats. | [93] |

**VI- Hepatoprotective activity**

| No. | Plant source | Organ | Extract/Fraction/Compound | Activity/Result | Ref. |
|-----|--------------|-------|----------------------------|-----------------|------|
| 76  | *Dendrocnide sinuata* (Blume) Chew. | Root-bark | Aqueous extract | It showed significant hepatic protection indicated by the serum enzymes levels, which was comparable to that of silymarin treated group which is also supported by histological findings using carbon tetrachloride (CCl\(_4\)) induced rats. | [94] |
| 77  | *Forsskaolea tenacissima* L. | Aerial parts | Total methanol extract and its fractions \((n\)-hexane and methanol\) | The total methanol extract exhibited hepatoprotective activity nearly the same as silymarin against (CCl\(_4\)) induced hepatic injury in albino rats followed by methanol fraction and finally \(n\)-hexane fraction. | [95] |
| 78  | *Urtica dioica* L. | Leaves | Methanol extract | It showed hepatoprotective activity with (CCl\(_4\)) induced rats method. | [26] |
| 79  | *Urtica dioica* L. | Seeds | Methanol extract | It exhibited hepatoprotective effect by increasing the activity of paraoxonase, arylesterase and liver tissue catalase activity using ischemia reperfusion induced hepatotoxicity method. | [26] |
| 80  | *Urtica dioica* L. | Whole plant | Hydro-methanol extract | It exhibited hepatoprotective activity with (CCl\(_4\)) induced rats method. | [26] |

**VII- Antioxidant activity**

| No. | Plant source | Organ | Extract/Fraction/Compound | Activity/Result | Ref. |
|-----|--------------|-------|----------------------------|-----------------|------|
| 81  | *Dendrocnide sinuata* (Blume) Chew. | Leaves | Aqueous extract | It exhibited antioxidant activity using scavenging activity of DPPH (1,1-diphenyl-2-picrylhydrazyl) radical method. | [65] |
| 82  | *Forsskaolea tenacissima* L. | Whole plant | Hexane, dichloromethane, ethyl acetate and methanol extracts | They showed antioxidant activity Dichloromethane, ethyl acetate and methanol extract with (DPPH) and N,N-dimethyl-p-phenyldiamine (DMPD), metal-chelation capacity, ferric-reducing (FRAP) and phospho-molibdenum-reducing antioxidant power (PRAP) methods using ELISA microtiter assays. | [57] |
### Table 2: Biological activities of family "Urticaceae" (cont.)

| No. | Plant source                           | Organ          | Extract/Fraction/Compound | Activity/Result                                                                                     | Ref.   |
|-----|----------------------------------------|----------------|---------------------------|-----------------------------------------------------------------------------------------------------|--------|
| 83  | *Forskaolea tenacissima* L.            | Aerial parts   | Total methanol extract and its fraction (n-hexane, dichloromethane, ethyl acetate and methanol) | The total methanol extract and methanol fraction have the highest antioxidant activity followed by ethyl acetate, dichloromethane and n-hexane fractions, respectively, using (DPPH) method. | [95]   |
| 84  | *Cecropia palmata* Willd.              | Leaves         | Hydro-methanol extract    | It showed antioxidant activity with oxygen radical antioxidant capacity (ORAC) and trolox equivalent antioxidant capacity (TEAC) assay. | [12]   |
| 85  | *Urtica dioica* L.                     | Leaves         | Methanol extract and phenolic fraction of plant extract | They showed antioxidant capacity with the Rancimat test using sunflower oil as substrate.           | [73]   |
| 86  | *Urtica dioica* L.                     | Whole plant    | Methanol extract          | It showed antioxidant activity using (DPPH) method.                                                | [96]   |
| 87  | *Pilea microphylla* L., *Elatostema umbellatum* Bl. and *Urtica dioica* L. | Leaves         | Total methanol extracts and its fractions (chloroform, diethyl ether, ethyl acetate and n-butanol) | The highest DPPH radical scavenging percentages were showed by the n-butanol and ethyl acetate fractions. | [3]    |
| 88  | *Forskaolea tenacissima* L.            | Whole plant    | Aqueous and methanol extracts | They showed high percentage of antioxidant activity using (TEAC) assay.                           | [97]   |
| 89  | *Urtica dioica* L.                     | Aerial Parts   | Chloroform, methanol and aqueous extracts | They showed antioxidant activity using (DPPH) method soybean oil models.                           | [98]   |
| 90  | *Fluerya aestuans* L.                  | Leaves         | Methanol extract          | It exhibited antioxidant activity using (DPPH) method.                                             | [99]   |
| 91  | *Myriocarpa stipitata* Benth.          | Whole plant    | n-Hexane, dichloromethane and aqueous methanol fractions | They showed antioxidant activity using (DPPH) method.                                              | [100]  |
| 92  | *Debregeasia salicifolia* Rendle.      | Roots and Leaves | Methanol extract          | It exhibited antioxidant activity using (DPPH) method.                                             | [101]  |
| 93  | *Laportea Aestuans* L.                 | Leaves         | Ethanol extract           | It exhibited high scavenging antioxidant activity using (DPPH) method.                            | [102]  |
| 94  | *Phenax rugosus* Wedd.                 | Whole plant    | Methanol and aqueous extract | They showed antioxidant activity using deoxyribose assay.                                         | [78]   |
| 95  | *Pouzolzia zeylanica* L.               | Whole plant    | Ethyl acetate extract     | It exhibited significant antioxidant activity using DPPH, hydroxyl radical scavenging assays and a reducing power assay. | [103]  |
| 96  | *Pipturus albidus* Hook. & Arn.        | Leaves         | Methanol extract          | It exhibited antioxidant capacity using the photochemiluminescence method.                         | [52]   |
| 97  | *Pilea microphylla* L.                 | Whole plant    | Methanol extract          | It showed antioxidant activity using DPPH free radical scavenging method.                          | [104]  |
| 98  | *Urtica dioica* L.                     | Leaves         | Ethanol extract           | It exhibited antioxidant activity using (DPPH) method.                                             | [105]  |

**VIII-Wound healing activity**

| No. | Plant source                           | Organ          | Extract/Fraction/Compound | Activity/Result                                                                                     | Ref.   |
|-----|----------------------------------------|----------------|---------------------------|-----------------------------------------------------------------------------------------------------|--------|
| 99  | *Forskaolea tenacissima* L.            | Aerial Parts   | Total methanol extract    | It showed marked increase in wound healing activity in comparison with gentamycin as positive control group with excision wound model. | [90]   |
7. Genus Pouzolzia showed 5 published biological activities, classified as (2 cytotoxicity, 2 antimicrobial and one antioxidant).
8. Genus Dendrocnide showed 5 published biological activities, classified as (2 antimicrobial, one anti-inflammatory, one hepatoprotective and one antioxidant).
9. Genus Pilea showed 4 published biological activities, classified as (2 cytotoxicity and 2 antioxidant).
10. Other genera showed very few biological activities.

Figure 3: Biological activities in various genera of Family “Urticaceae”.

3. Conclusion

This review provides valuable information about the various phytocannabinoids and biological activities of family "Urticaceae" for the first time. It is reported that "Urticaceae" plants contain different classes of chemical constituents including triterpenes, sterols, flavonoids, lignans, sesquiterpenes, alkaloids, simple phenolic and miscellaneous compounds together with a several medicinal benefits such as cytotoxic, antimicrobial (antibacterial, antifungal and antiviral), anti-inflammatory, anti-diabetic, anti-benign prostatic hyperplasia, hepatoprotective, antioxidant as well as wound healing. According to the present review, many genera of family "Urticaceae" are considered as good points of interest and further studies to explain the mechanisms of action of their biological actions that assists to develop and explore new drugs from natural source.

Declarations of interest

The authors declare that they have no conflict of interest.

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