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Review Article

PHYTOCHEMICAL AND PHARMACOLOGICAL PROPERTIES OF THE GENUS *GREWIA*: A REVIEW

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ABSTRACT

A number of species of genus *Grewia* have been used as medicinal agents to treat several disease. The large flowering plant genus *Grewia* is belongs to family Tiliaceae and reported for its medical importance. Various parts of different species exhibit different medicinal importance and yet to be phytochemically investigated. This review based on knowledge of traditional uses, chemistry, biological effects and toxicity of different species of this genus. Triterpenoids, steroids, glycosides, flavones, lignanes, phenolics, alkaloids, lactones and organic acids have been isolated from various species of this genus. The extract and preparation from various species exhibited various biological effects, e.g. antioxidant, anti-bacterial and analgesic effect.

Keywords: Activity, Flavonoids, *Grewia*, Steroid, Triterpenoid.

INTRODUCTION

The genus *Grewia* belongs to family Tiliaceae. This genus comprising shrubs and trees and is distributed in the warmer parts of the world. Nearly 40 species of this genus are found in India some of which are well known for their medicinal value[1-3].

Pharmacological properties

The different parts of different species of genus *Grewia* are used as folk medicine in the different part of globes. Diverse bioactivity studies on different species of genus *Grewia* have been reported. The roots of *G. abutilifolia* are applied to abscesses[4]. The fruit of *G. asiatica* is astringent and cooling. Infusion of bark is demulcent while leaves are used in pustular eruptions. Its root bark is used as a remedy for rheumatism. 50% Ethanolic extract of aerial parts of *G. asiatica* showed hypotensive activity while the aqueous extract of stem bark is reported to be antidiabetic[5]. Its seed extract and seed oil exhibited antifertility activity[6]. Fruit Extract of *G. asiatica* shows radioprotective Effect in Swiss Albino Mice Against Lethal Dose of γ-irradiation[7]. The fruit is astringent and stomachic. It is reported that unripe phalsa fruit alleviates inflammation and is administered in respiratory, cardiac and blood disorders, as well as in fever reduction[8]. Furthermore, infusion of the bark is given as a demulcent, febrifuge, and treatment for diarrhea. *Grewia asiatica* contains anthocyanin type cyanidin 3- glucoside[9], vitamin C, minerals and dietary fibers etc[10]. The antioxidant properties of vitamin C are well known and anthocyanin has recently emerged as a powerful antioxidant. Pet. ether extract of *G. bicolor* is used for treating postulant skin lesions[11]. *Grewia bicolor* is a part of Sudanese traditional medicine, and is used in the treatment of skin lesions and sometimes also as a tranquilizer[12]. The three alkaloids, Harman, 6-methoxyharman, and 6-hydroxyharman, isolated from the methanol extract of this plant, have antibacterial properties[12]. Chloroform extract of the aerial parts of *G. bilamellata* exhibited antimalarial activity against the D6 and W2 clones of *P. falciparum*[13]. *Grewia carpinifolia* is used in washing hair to remove and prevent lice. Ethanolic extract of stem bark of *G. elastica* showed CNS depressant activity[14] . Various parts of *G. hirsuta* are used in headache, eye complaints, sores and cholera while ethanolic extract of stem bark exhibited antiviral and diuretic activity[5,15]. The leaves are useful in nose and eye diseases, treating splenic enlargement, piles, rheumatism and relieving joint pain while the roots are used in diarrhea, dysentery and as a dressing for wounds. The plant *G. microcos* is used for treating indigestion, eczema and itch, small pox, typhoid fever, dysentery and syphilitic ulceration of the mouth. *Grewia mollis* is known to be a strong fireresistant.Various parts of the plant are used in food and medicine. In Nigeria, the stem bark powder or mucilage is used as a thickener in local cakes made from beans or corn flour commonly called "Kosai" and "Punkasau" in Hausa (Nigeria), respectively. The dried stem bark is ground and the powder mixed with beans or corn flour thereby enhancing the texture of the food product[16]. The flowers and young shoots are sometimes used as a soup or sauce vegetable. The infusion of the bark obtained by cold or hot maceration in water is used in beating mud floors, or mixed with the mud or the walls of huts to give a smooth surface. The mucilaginous property of the bark or leaf is used in application to cuts and sores. The Yoruba in Nigeria use it medicinally at times of child birth[16]. Some findings demonstrated that the mucilage obtained from the stem bark can serve as a good binder in paracetamol formulations[17,18]. Also the recent reports suggest that high concentration of stem bark in dietary exposure may cause some adverse effects, especially liver injury[19]. Phytochemical studies of *G. mollis* indicated the presence of tannins, saponins, flavonoids, glycosides, phenols, steroids and the absence of alkaloids in the leaves and stem bark[20] while their presence was revealed in the roots[21]. Crude methanolic extract of *G. mollis* exhibited antimicrobial activity[22]. Plant parts of *G. sapida* are used in ulcerated tongue, colic, wounds, cholera and dysentery[1-3]. The roots of *G. sclerophylla* are prescribed in cough and irritable conditions of intestine and bladder, while its decoction is used as an emollient enema while alcoholic extract of aerial parts demonstrated anticancer activity[23] while that of *G. serrulata* showed anti-inflammatory activity[15]. The bark of *G. tiliaefolia* is used to heal wounds, cure kapha, vata, burning sensation, throat complaints, biliousness and disease of the nose and blood. It is also used in dysentery and externally employed to remove the irritation from cow-itch. Its wood in powder form is emetic and antidote to opium poisoning. In *G. tiliaefolia*, the ethanolic extract of aerial parts exhibited CNS depressant and diuretic activity while that of stem bark exhibited spermic and hypotensive activity[15]. The leaves of *G. umbellata* are used for treating cuts and wounds. The bark and roots of *Grewia tiliaefolia* are used to treat skin diseases, hypertension, ulcers and diarrhoea[24]. Lupenol, isolated from this plant, is known to cause apoptosis in several cancer cells[25]. The aerial parts of *G. umbellifera* exhibited CNS depressant, hypotensive and diuretic activities[26] The juice of fresh bark of *G. villosa* is used with water and sugar for gonorrhoea and urinary complaints and the roots is used in diarrhea. Other parts of the plant are used in sores, wounds, cholera and dysentery[1-3,27] while the stem extract of *G. villosa* was found to be active in KB cell culture[28]. An extract of *Grewia villosa* extract is used in treatment of tuberculosis[29], and this plant is also known to contain harman alkaloids. Harman alkaloids belong to the class of β-carbolines and bind strongly to receptors in the brain and affect the CNS[30]. The mucilage of bark of *Grewia tenax* is reported to possess bactericidal activity and is used in the treatment of tuberculosis in hilly areas. The decoction of wood is given in cough and pains[1-3]. In Sudan, the roots are used for curing various skin diseases[31], The ethanolic extract of the aerial parts was found to exhibit CNS depressant activity[32]. *Grewia tenax* (Forsk.) Fiori, *G. flavescens* Juss and *G. villosa* Willd fruits, when ripe, are either eaten fresh or left to dry for consumption at a later date. In Sudan, a drink is prepared by soaking the fruits over-night, and then they are hand pressed, sieved and sweetened. A light porridge is prepared by the addition of flour or custard to *Grewia*

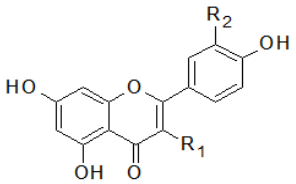
drink and served during the fasting month of Ramadan and is also fed to lactating mother to improve their health and lactating abilities. Moreover, the fruits are made into a fermented drink in Sudan and Southern Africa[33]. *G. tenax* fruit was reported to contain large amounts of iron[34] and as such is used for treatment of anemia and malaria[35].

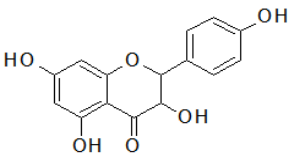
Phytochemical evaluation

Phytochemically, the genus *Grewia* has been found to possess mainly triterpenoids, fatty component, flavonoids, steroids, saponins and tannins. The compounds isolated from the various species are given in following table.

Table 1: Compounds isolated from genus *Grewia.*

Plant species	Plant part	Compounds isolated	References
G. asiatica	Flowers	Flavonoids: quercetin (I), quercetin-3-O-β-D-glucoside, naringenin (II) and naringenin-7-O-β-D-glucoside ; grewinol (III), 3,21,24-trimethyl-5,7-dihydroxyhentriacontanoic acid δ-lactone (IV) and β-sitosterol	36-38
	Fruits	Flavonoids: quercetin (I), quercetin-3-O-β-D-glucoside and naringenin-7-O-β-D-glucoside; anthocyanins: pelargonidin-3,5-diglucoside (V), delphinidin-3-glucoside (VI) and cyanidin-3-glucoside (VII); and catechin (VIII)	39-41
	Leaves	Flavonoids: quercetin (I) and kaempferol (IX) and their glucosides	42
	Stem	Triterpenoids: taraxerol, erythrodiol (X), lupeol (XI), betulin (XII), lupenone, friedelin (XIII) and β-amyrin; β-sitosterol	43-45
G. bicolor	Whole plant	Triterpenoids: lupeol (XI) and betulin (XII) ; β-sitosterol and β-sitosterol-3-O-glucoside Alkaloids: Harman (XIV), 6-methoxyharman (XV) and 6-hydroxyharman (XVI)	11
G. bilamellata	Aerial parts	Coumarinolignans: grewin(XVII) and cleomiscosin D(XVIII); neolignans: nitidine(XIX) and bilagrewine(XX); triterpenoids: 3α,20-lupanediol (XXI) and 2α-3β-dihydroxy-olean-12-en-28-oic acid(XXII); pyran derivative: icariol A_2; sterol: daucosterol; 8-O-4'-neolignanguaiacylglycerol-β-coniferyl ether; 2,6-dimethoxy-1-acetonylquinol(XXIII) and ciwujiatone(XXIV)	13
G. elyseoi	Stem bark	Coumarinolignan : grewine(XVII)	46
G. flavescens	Roots	Triterpenoids: α-amyrin, β-amyrin, betulin(XII) and friedelin(XIII); triacontanol and β-sitosterol	47
	Stem bark	Triterpenoids: α-amyrin, β-amyrin and erythrodiol(X); β-sitosterol	48
G. mollis	Aerial parts	Flavonoids: Luteloin (XXV), 7-(1-O-β-D-galacturonide)-4'-(1-O- β-glucopyranosyl)-3'4',5,7-Tetrahydroxyflavone (XXVI), Triterpenoids: 7β-hydroxy-23-ene-deoxojessic acid (XXVII), 7β-hydroxy-23- deoxojessic acid (XXVIII), Steroids: β-Sitosterol, β-Sitosterol-3-*O*-glucoside (XXIX).	21,22
G. rothi	Root bark	Triterpenoid: lupeol(XI); leucoanthocyanidin(XXX)	49
G. tenax syn. G. populifolia	Leaves	Triacontanol, tetratriacont-21-ol-12-one and β-sitosterol	50
	Seeds	Sterols: sitosterol and stigmasterol(XXXI)	51
	Stem bark	Triterpenoids: α-amyrin, β-amyrin, lupenone, erythrodiol(X) and betulin(XII); β-sitosterol and triacontanol	52,48
G. tiliaefolia	Roots	Triterpenoids: lupeol(XI) and friedelin(XIII)	53
	Stem bark	Triterpenoids: lupeol(XI), betulin(XII) and friedelin(XIII)	53,54
G. tomentosa	Whole plant	Tiliroside(XXXII) and luteolin(XXXIII)	55





(I) : $R_1 = R_2 = OH$ **(II)**

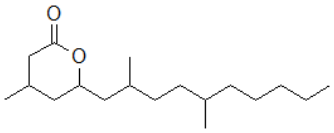
(IX) : $R_1 = OH, R_2 = H$

(XXXIII) : $R_1 = H, R_2 = OH$

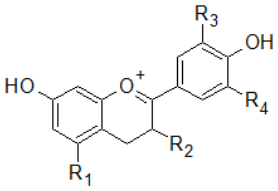
$CH_3\text{-}(CH_2)_{11}\text{-}CO\text{-}(CH_2)_8\text{-}CH(OH)\text{-}(CH_2)_{11}\text{-}CH_3$

(III)

Fig. 1: (*Continued*)



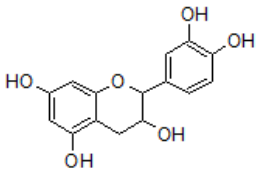
(IV)



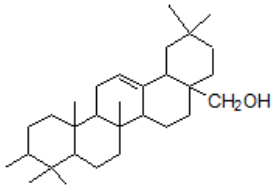
(V) : $R_1 = R_2 = Glc$, $R_3 = R_4 = H$

(VI) : $R_1 = R_3 = R_4 = H$, $R_2 = Glc$

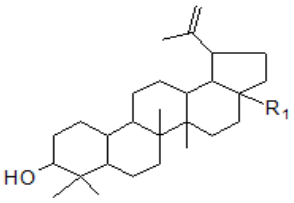
(VII) : $R_1 = R_3 = OH$, $R_2 = Glc$, $R_4 = H$



(VIII)

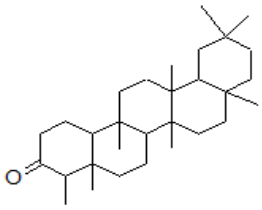


(X)

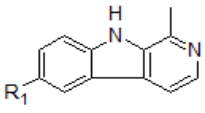


(XI) : $R_1 = CH_3$

(XII) : $R_1 = CH_2OH$



(XIII)

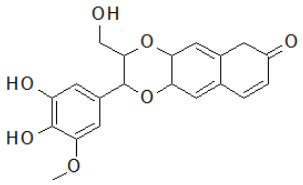


(XIV) : $R_1 = H$

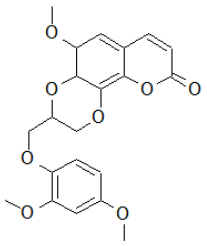
(XV) : $R_1 = OCH_3$

(XVI) : $R_1 = OH$

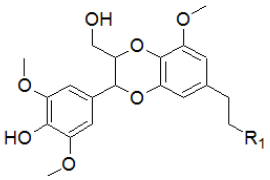
Fig. 1: (*Continued*)



(XVII)

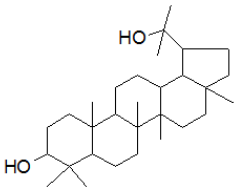


(XVIII)

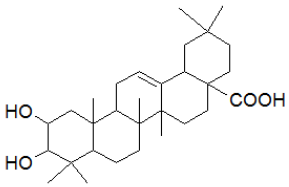


(XIX) : $R_1 = CH_2OH$

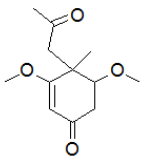
(XX) : $R_1 = CHO$



(XXI)



(XXII)



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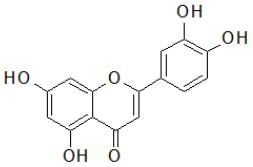
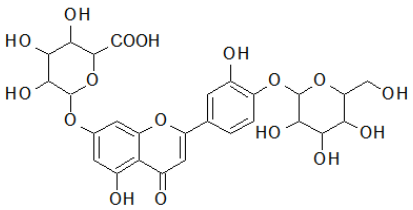
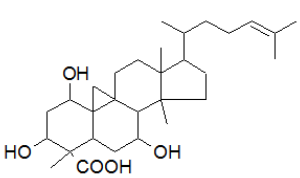


(XXV)



(XXVI)



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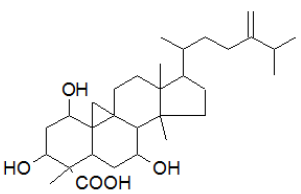
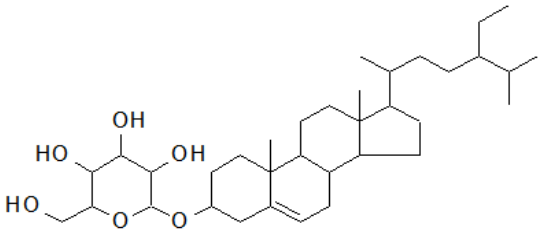


(XXVIII)

Fig. 1: (*Continued*)



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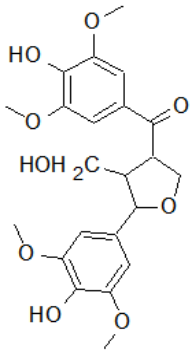

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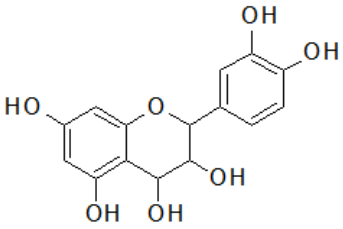

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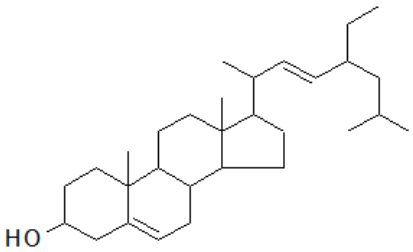

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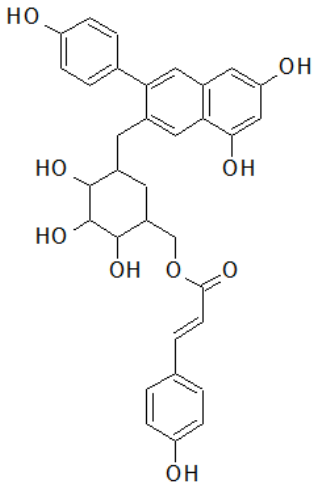

(XXXII)

Fig. 1: Structures of compounds isolated from the genus *Grewia*

CONCLUSION

Grewia, the versatile genus of medicinal plant is the unique source of various types of compounds having diverse chemical structure. A very little work has been done on the biological activity and possible medicinal application of its phytochemical. It is very useful traditional plant genus, crude extract from various part of various species have a therapeutic uses from time immemorial, so that some active constituent can developed for future studies. The global scenario is changing their face towards herbal medicinal uses due to less side effect and emphasis given to develop a modern drug to cure many acute disease. Therefore this review given to find out new activity or new entity responsible for various therapeutic activity.

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