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REVIEW ARTICLE

RECORDS OF PHARMACEUTICAL AND BIOMEDICAL SCIENCES

Chemical Review on Genus *Zygophyllum*

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Abstract

Nature has always been an imminent source of various bioactive compounds. Due to natural products efficacy and safety, they have remained the preferred medicines despite their competition with synthetic ones. Plants have long been used as remedies to cure a variety of illnesses. Plants chemical investigation has led to the isolation of many biologically active compounds that are in use today. The plant family *Zygophyllaceae* approximately contains 27 genera and 285 species, and the biggest genus of this family is *Zygophyllum* which has approximately 80 species, studying these various species has revealed a large number of bioactive compounds belonging to different chemical classes such as triterpenes, sterols, flavonoids, saponins, polyphenols and essential oils. Plants belong to this genus have been used for traditional medicine in many diseases such as diabetes, hypertension, asthma, gout and rheumatism. This review demonstrates that the genus *Zygophyllum* is a rich source of saponins, triterpenes, sterols, flavonoids, and essential oils.

Keywords: *Zygophyllum*, Flavonoids, Saponins.

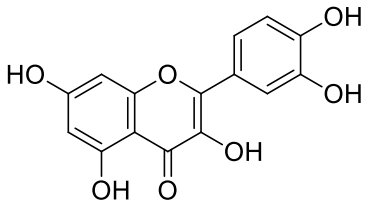
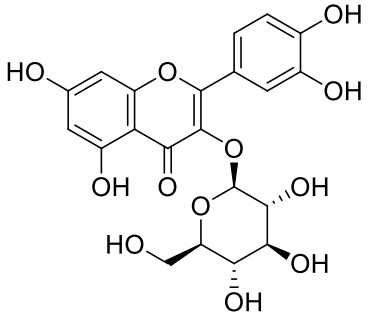
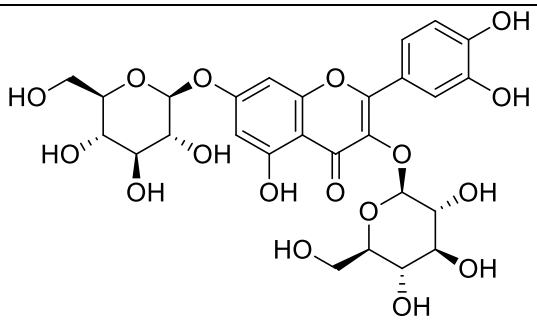
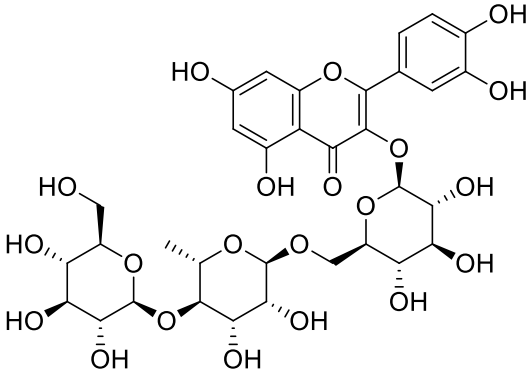
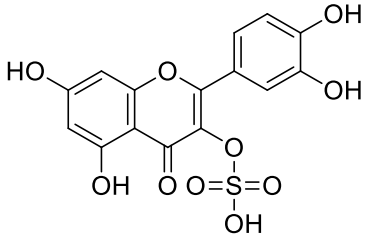
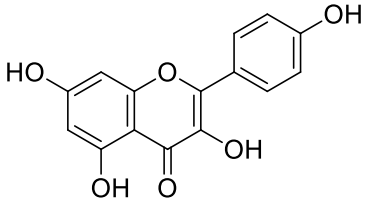
1. Introduction:

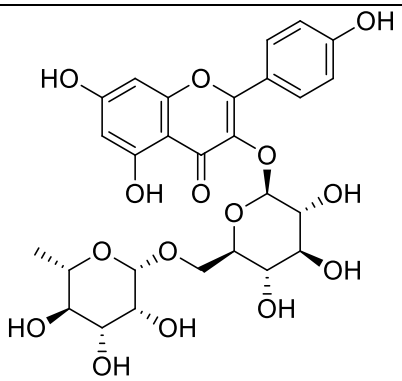
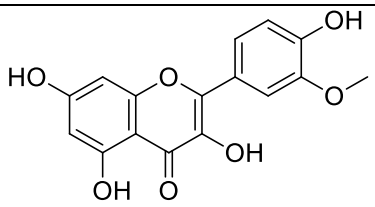
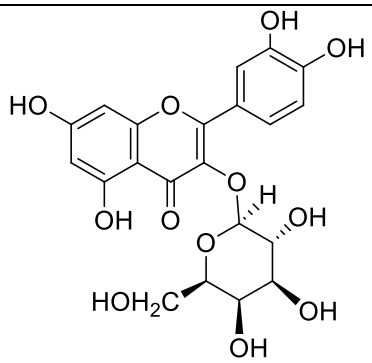
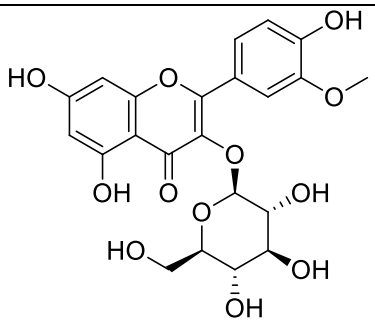
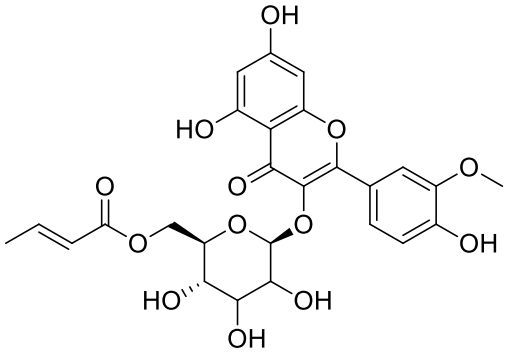
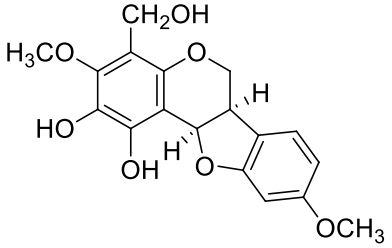
Through years nature has been an imminent source of various bioactive compounds (**Pinheiro *et al.*, 2018**). Due to natural products efficacy and safety, they have remained the preferred medicines despite their competition with synthetic ones. Plants have long been used as remedies to cure a variety of illnesses. Natural products sources are generally two types. Firstly, the terrestrial supply that has plants, animals, and microorganisms, and secondly, the marine supply that focuses on invertebrates (**Kijjoa and Sawangwong, 2004**). Plant investigation for discovering new drugs has resulted in isolating many significant anticancer medicines as camptothecin and paclitaxel (**Veeresham *et al.*, 2012**).

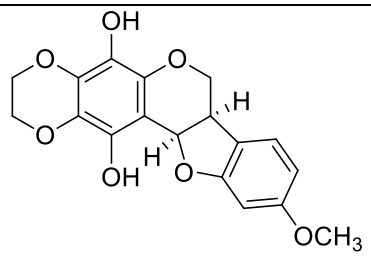
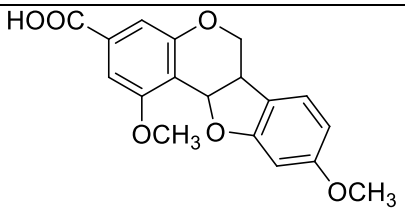
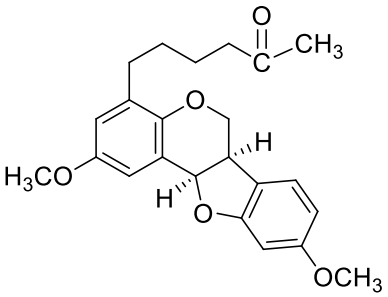
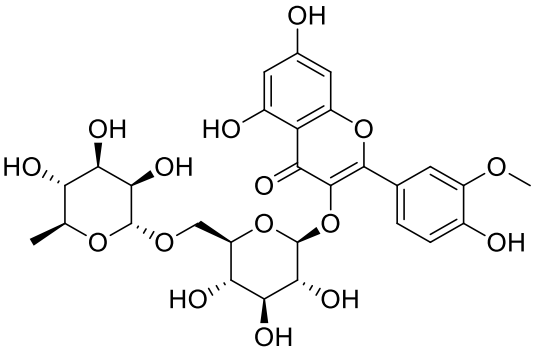
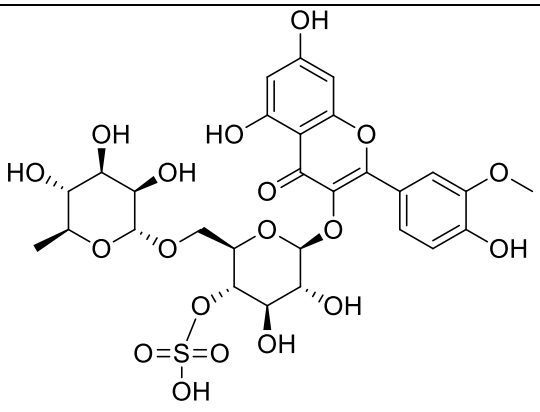
The plant family *Zygophyllaceae* approximately contains 27 genera and 285 species, and the biggest genus of this family is *Zygophyllum* which consist of 80 species (**Hussein *et al.*, 2011**). From different *Zygophyllum* species, a variety of bioactive compounds have been discovered, including triterpenes, sterols, flavonoids, saponins, polyphenols and essential oils (**Mohammedi *et al.*, 2020**). Plants belong to this genus have been used for traditional medicine in many diseases such as diabetes, hypertension, gout and rheumatism (**Shawky *et al.*, 2019**). Based on the previous reports, this review aims to introduce a thorough update on the chemistry of species belonging to genus *Zygophyllum*.

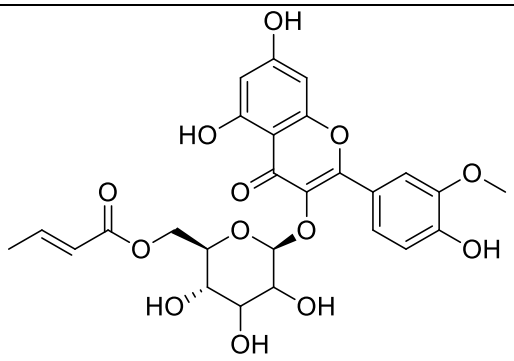
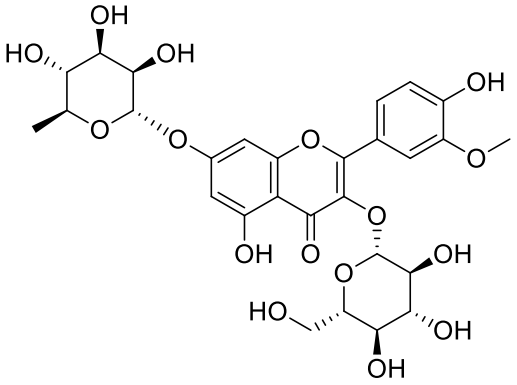
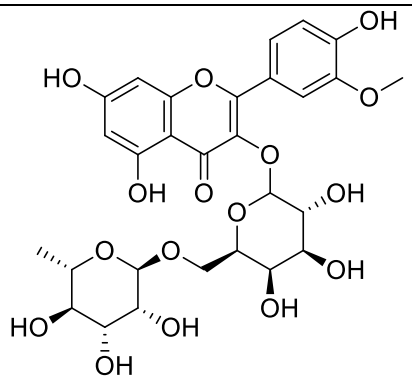
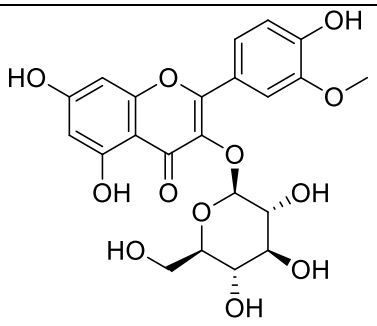
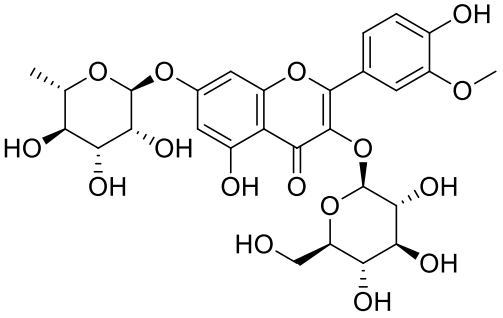
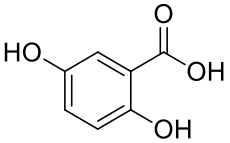
2. Chemical constituents reported from species of genus *Zygophyllum*

Table 1: Flavonoids:

Species	Compound Name	Compound Structure	Reference	Part used
Z. album ***Z. dumosum*** ***Z. fabago***	**Quercetin**		**(Mnafgui *et al.*, 2012) (Abdel-Hamid *et al.*, 2016) (Bourgou *et al.*, 2017)**	**Aerial**
Z. album ***Z. dumosum*** ***Z. simplex***	**Quercetin-3-O-*β*-glucopyranoside (Isoquercitin)**		**(Shawky *et al.*, 2019) (Amin *et al.*, 2011)**	**Aerial**
Z. album ***Z. dumosum***	**Quercetin-3,7-di-O-*β*-glucopyranoside**		**(Mnafgui *et al.*, 2012) (Bourgou *et al.*, 2017)**	**Aerial**
Z. album ***Z. dumosum*** ***Z. simplex***	**Quercetin 3-O-rutinoside (Rutin)**		**(Hussein *et al.*, 2011) (Bourgou *et al.*, 2017)**	**Aerial**
Z. album	**Quercetin-3-sulphate**		**(Bourgou *et al.*, 2017)**	**Aerial**
Z. album ***Z. dumosum*** ***Z. fabago***	**Kaempferol**		**(Shawky *et al.*, 2019) (Bourgou *et al.*, 2017)**	**Aerial**

Z. album ***Z. dumosum*** ***Z. simplex***	**kaempferol 3-O-rutinoside (Nicotiflorin)**		**(Hassanean *et al.*, 1993)** **(Bourgou *et al.*, 2017)**	**Aerial**
Z. album ***Z. fabago*** ***Z. simplex***	**Isorhamnetin**		**(Shawky *et al.*, 2019)** **(Abdel-Hamid *et al.*, 2016)**	**Aerial**
Z. album	**Isorhamnetin-3-O- *β* -galactopyranoside**		**(Mnafgui *et al.*, 2012)** **(Shawky *et al.*, 2019)**	**Aerial**
Z. album ***Z. decumbens*** ***Z. simplex***	**Isorhamnetin-3-O- *β* -glucopyranoside**		**(Mnafgui *et al.*, 2012)** **(Bourgou *et al.*, 2017)**	**Aerial**
Z. simplex	**Isorhamnetin 3-[6″-(2(E) butenoyl) glucoside]**		**(Shawky *et al.*, 2019)**	**Aerial**
Z. atriplicoides (Synonym: Z. eurypterum)	**Atricarpan A**		**(Ahmad *et al.*, 2006)**	**Whole plant**

Z. atriplicoides (Synonym: Z. eurypterum)	**Atricarpan B**		**(Ahmad *et al.*, 2006)**	**Whole plant**
Z. atriplicoides (Synonym: Z. eurypterum)	**Atricarpan C**		**(Ahmad *et al.*, 2006)**	**Whole plant**
Z. atriplicoides (Synonym: Z. eurypterum)	**Atricarpan D**		**(Ahmad *et al.*, 2006)**	**Whole plant**
Z. album ***Z. aeyptium*** ***Z. coccienium*** ***Z. Cornutum*** ***Z. decumbens***	**Isorhamnetin-3-O-a-rhamnopyranosyl-(1/6)-O-b-glucopyranoside (isorhamnetin-3-O-*β*-rutinoside)**		**(Mnafgui *et al.*, 2012) (Hussein *et al.*, 2011) (Hassanean *et al.*, 1993) (Shawky *et al.*, 2019) (Zaki *et al.*, 2016) (Bourgou *et al.*, 2017)**	**Aerial**
Z. dumosum	**Isorhamnetin-3-(4′′-sulfatorutinoside)**		**(Shawky *et al.*, 2019)**	**Aerial**

Z. dumosum	**Isorhamnetin 3-[6''-(2(E) butenoyl)-glucoside]**		**(Shawky *et al.*, 2019)**	**Aerial**
Z. dumosum	**Isorhamnetin-3-O-*β*-glucopyranoside-7-O-*α*-rhamnopyranoside**		**(Shawky *et al.*, 2019)**	**Aerial**
Z. album	**Isorhamnetin-3-O-a-rhamnopyranosyl-(1/6)-O-*β*-galactopyranoside (isorhamnetin-3-O-robinoside)**		**(Mnafgui *et al.*, 2012)**	**Aerial**
Z. album	**Isorhamnetin-3-O glucoside**		**(Hussein *et al.*, 2011) (Shawky *et al.*, 2019)**	**Aerial**
Z. album	**Isorhamnetin-3-O-b-glucopyranoside-7-O-*a*-rhamnopyranoside**		**(Mnafgui *et al.*, 2012)**	**Aerial**
Z. album	**Gentisic acid (Hydroquinone carboxylic acid)**		**(Mnafgui *et al.*, 2012)**	**Aerial**

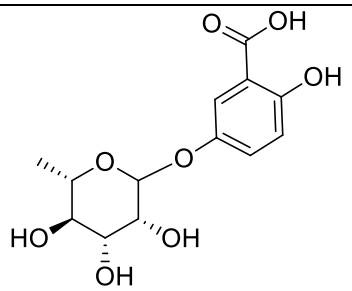
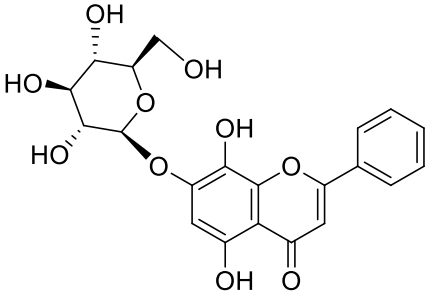
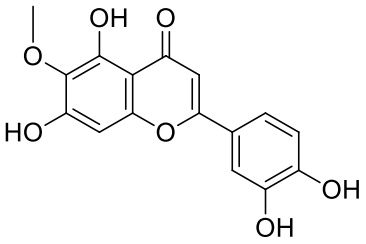
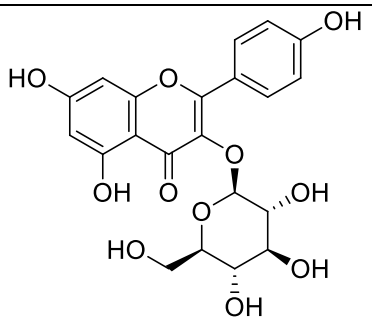
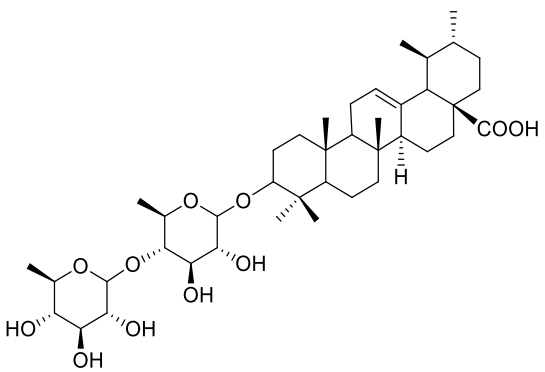
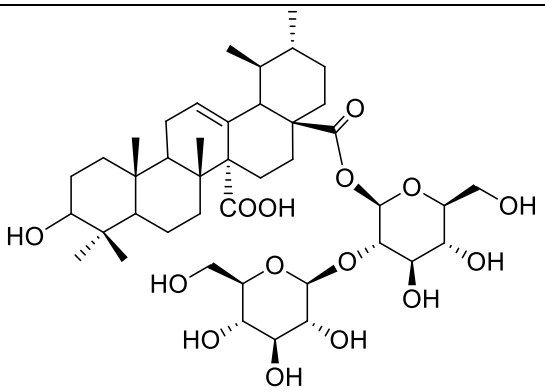
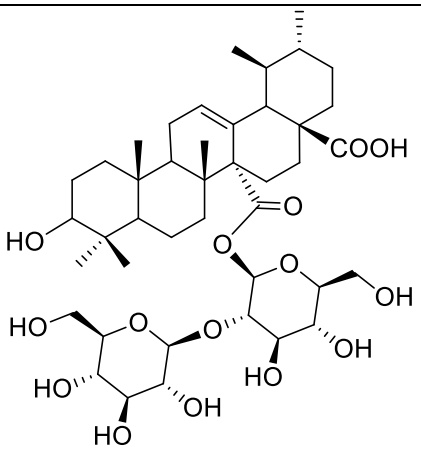
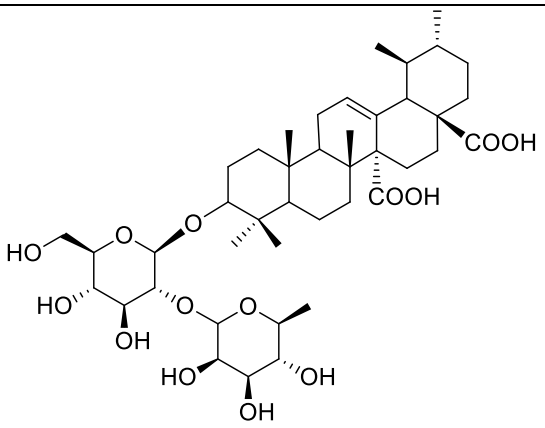
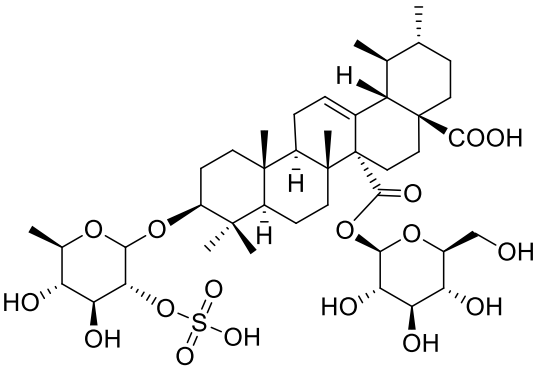
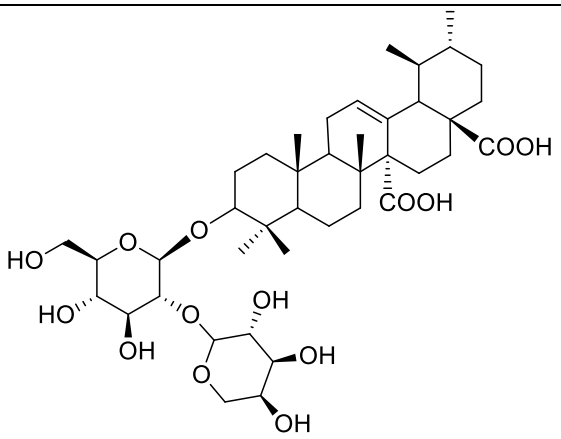
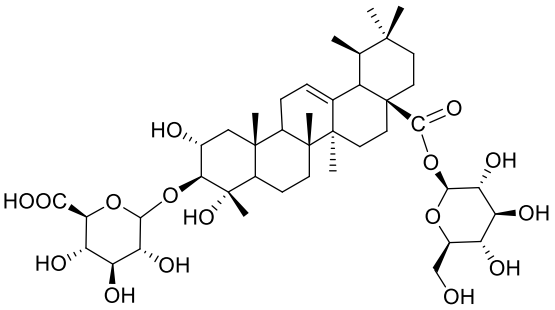
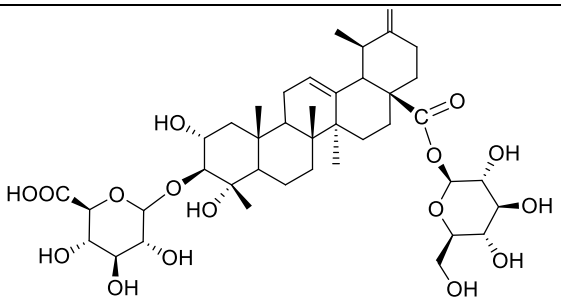
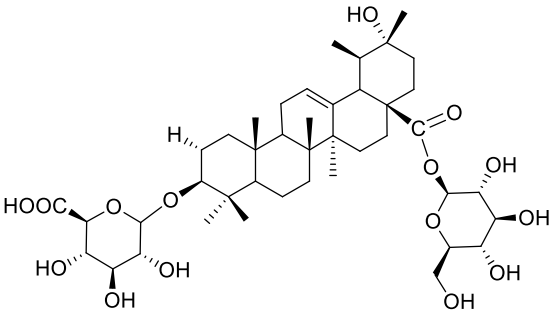
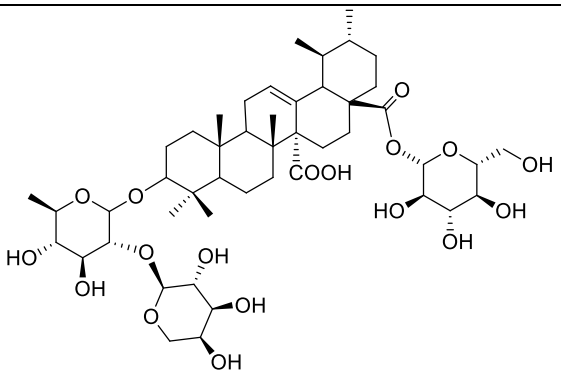
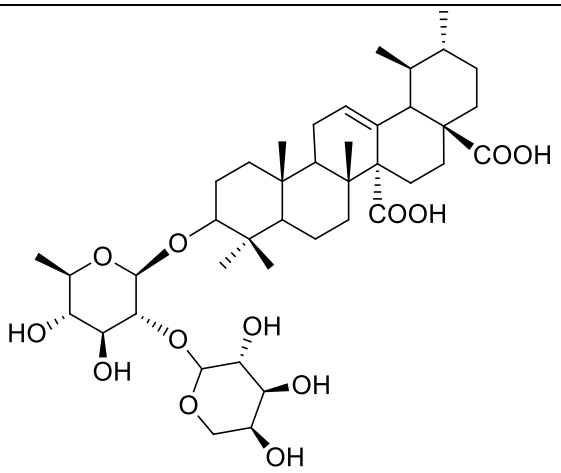
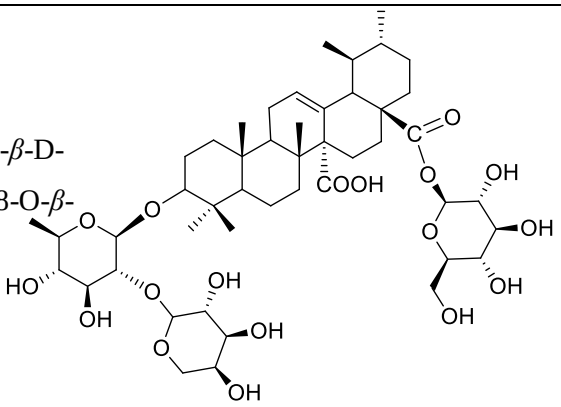
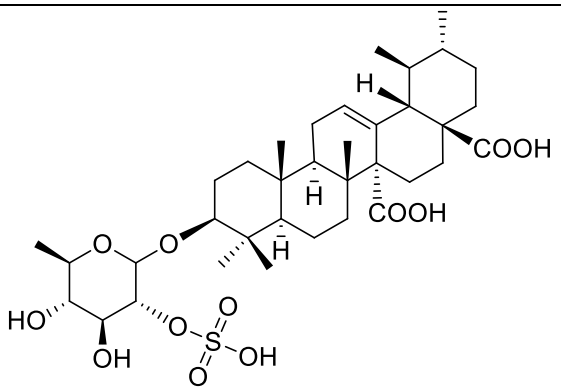
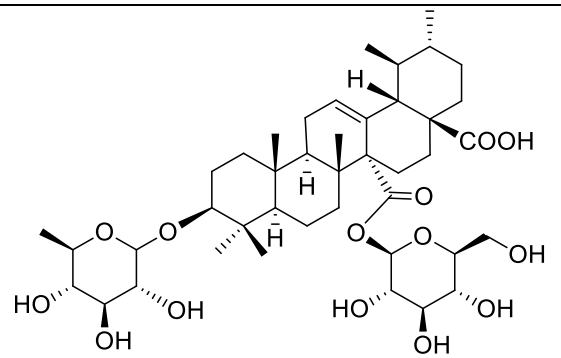
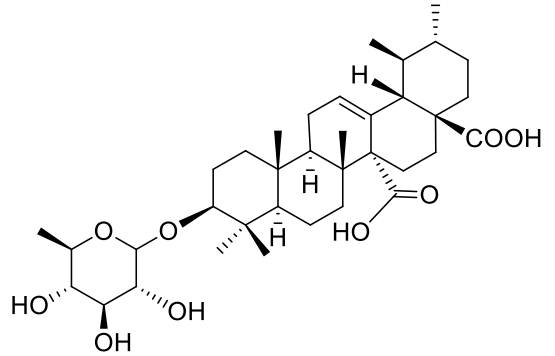
Z. album	**Gentisic acid 5-O-*α* -rhamnopyranoside**		**(Mnafgui *et al.*, 2012)**	**Aerial**
Z. coccienium	**5,6,7,8,4`penta hydroxy flavone 7 -*β* - D glucoside**		**(Shawky *et al.*, 2019)**	**Aerial**
Z. coccienium	**2-(3, 4-Dihydroxyphenyl)-3, 5, 7-trihydroxy-6-methoxy-4-benzopyrone (Patuletin)**		**(Shawky *et al.*, 2019)**	**Aerial**
Z. melongena	**kaempferol 3-O-*β*-D-glucoside**		**(Ganbaatar *et al.*, 2016)**	**Aerial**

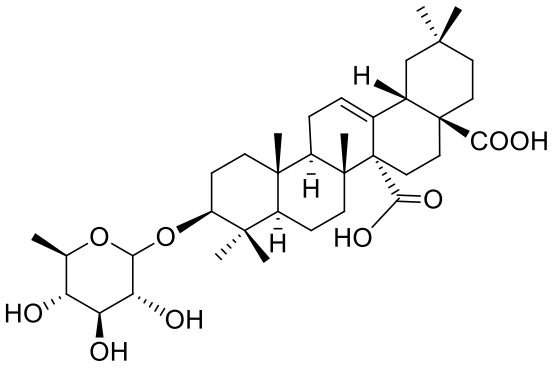
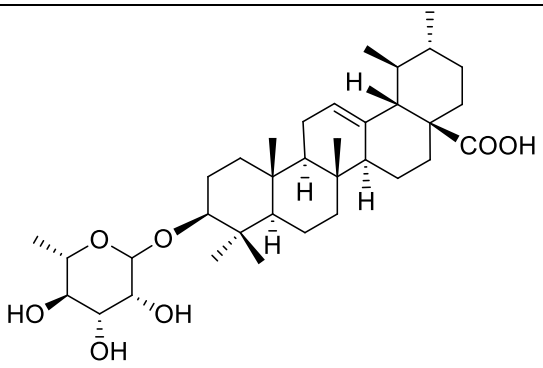
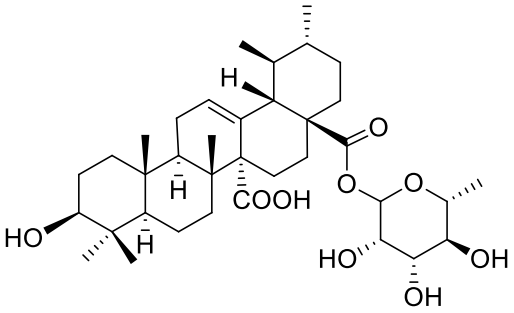
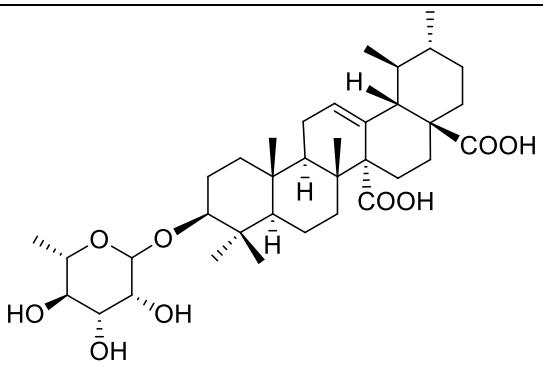
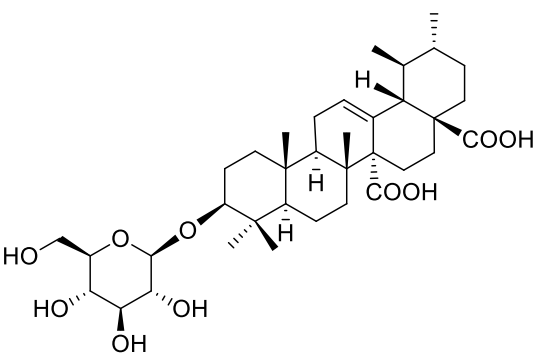
Table 2: Saponins:

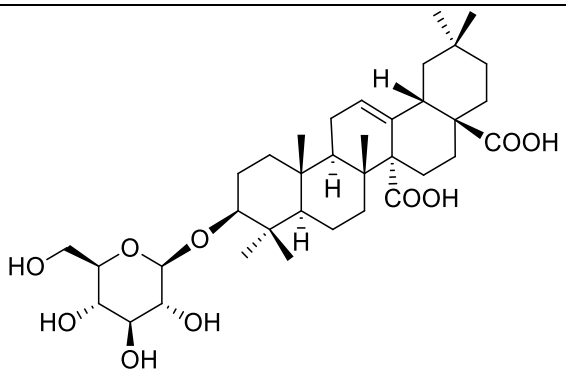
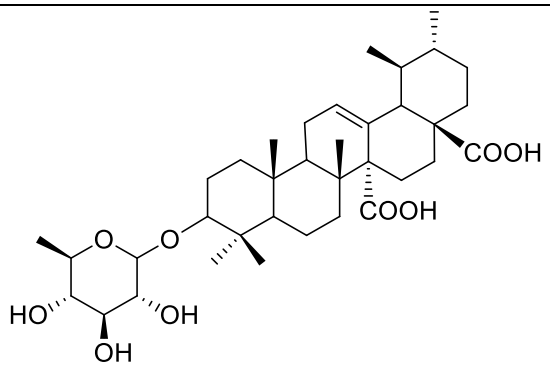
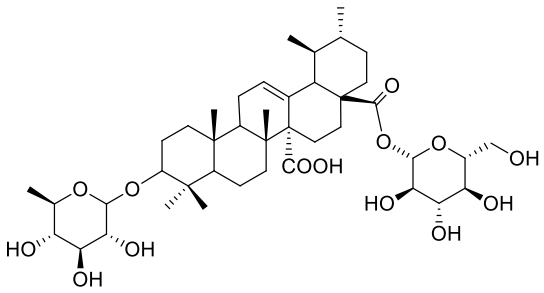
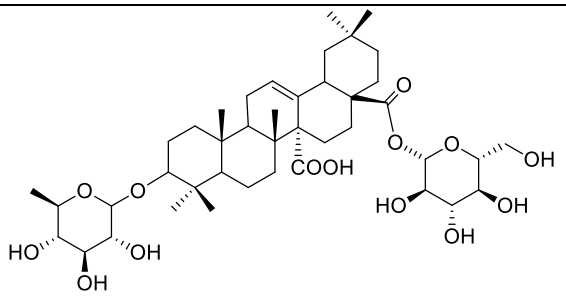
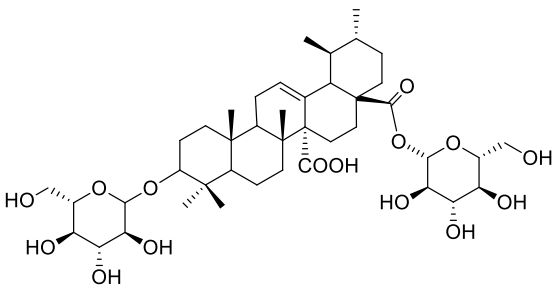
Species	Compound Name	Compound Structure	Reference	Part used
Z. album	14-decarboxyquinovic acid-3*β*-*o*-*β*-*D*-quinovopyranosyl (l → 4)-quinovopyranoside		**(Hassanean *et al.*, 1993b)**	**Aerial**

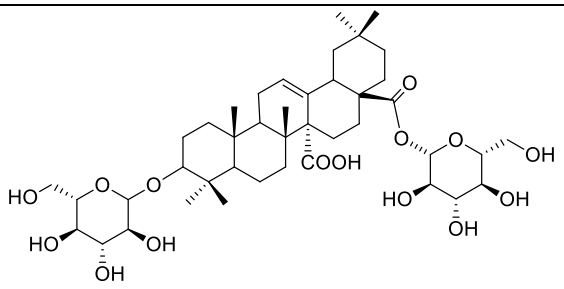
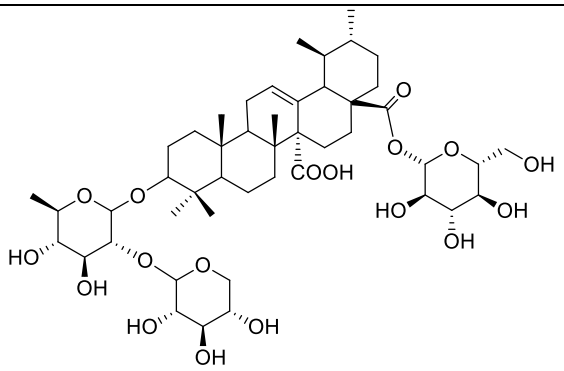
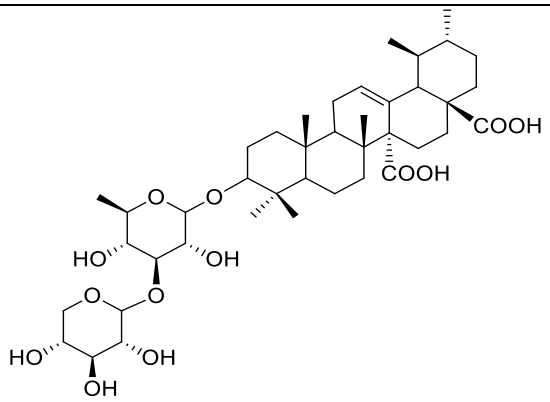
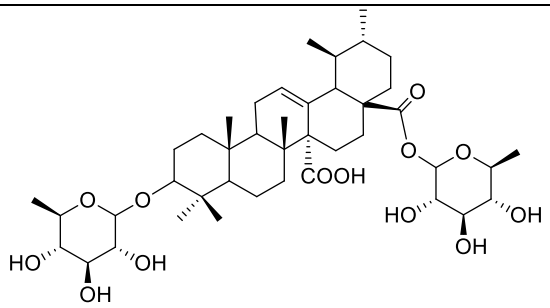
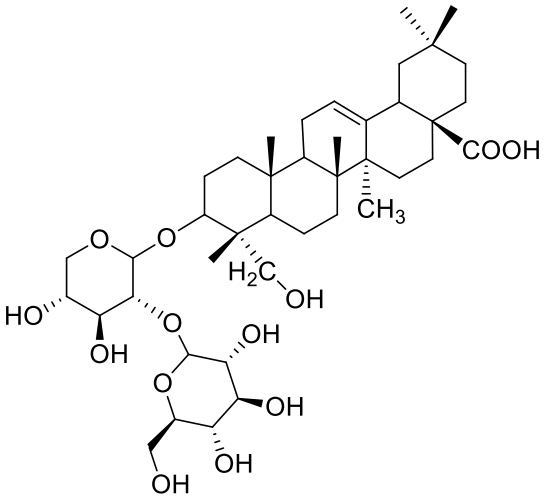
Z. album	Quinovic acid 28-*O*- *β* -D-glucopyranosyl (2 → l) *β* -D-glucopyranosyl ester.		**(Hassanean *et al.*, 1993b)**	**Aerial**
Z. album	Quinovic acid 27-*O*- *β* -D-glucopyranosyl (2 → l) *β* -D-glucopyranosyl ester		**(Hassanean *et al.*, 1993b)**	**Aerial**
Z. album	Quinovic acid-3- *β* -*O*-glucopyranosyl(2 → 1)rhamnopyranoside.		**(Hassanean *et al.*, 1993b)**	**Aerial**
Z. album ***Z. coccineum*** ***Z. dumosum*** ***Z. propinquum***	Zygophyloside F 3-*O*-[*β* -D-2-*O*-sulphonylquinovopyranosyl]-quinovic acid-27-*O*-[*β* -D-glucopyranosyl] ester		**(Elgamal *et al.*, 1995) (Ahmad *et al.*, 1993)**	**Aerial Of *Z. album*** **Root of *Z. coccineum*** **Aerial Of *Z. dumosum***

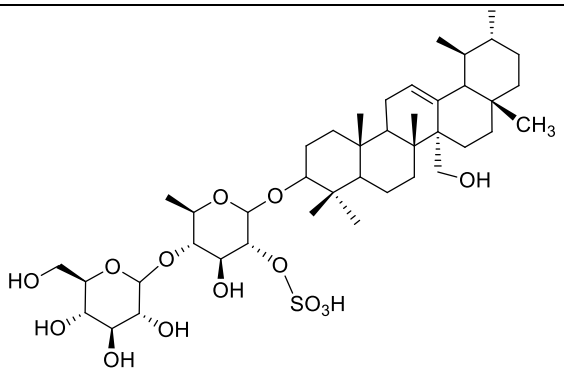
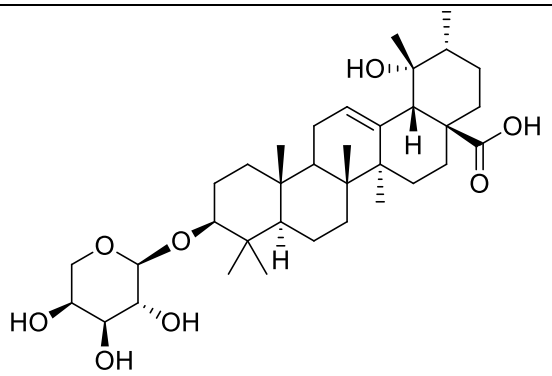
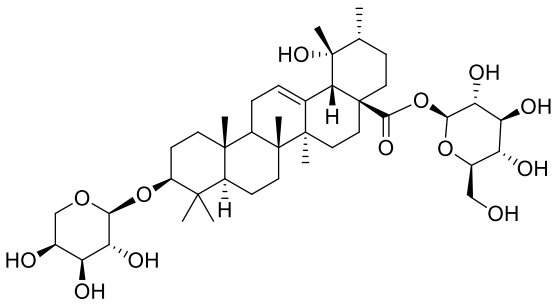
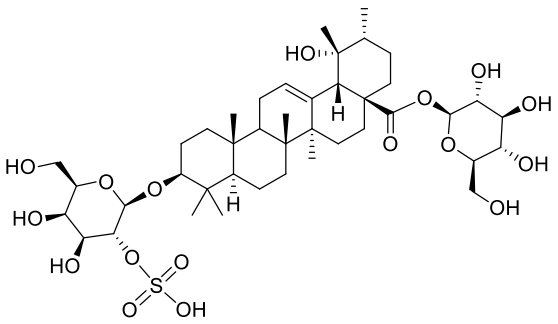
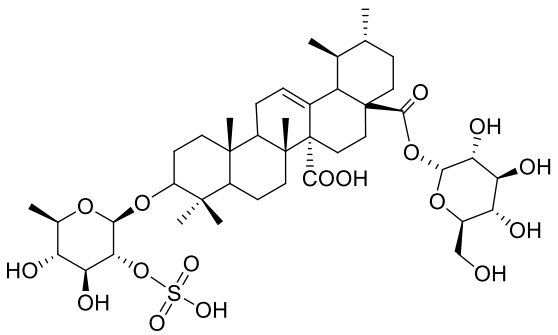
Z. coccineum	Zygophylloside S		**(Amin *et al.*, 2010)**	**Aerial**
Z. decumbens	Zygophyloside I		**(Pöllmann *et al.*, 1998)**	**Whole plant**
Z. decumbens	Zygophyloside J		**(Pöllmann *et al.*, 1998)**	**Whole plant**
Z. decumbens	Zygophyloside K		**(Pöllmann *et al.*, 1998)**	**Whole plant**
Z. gaetulum	Zygophyloside H		**(Belguidoum *et al.*, 2022)**	**Aerial**

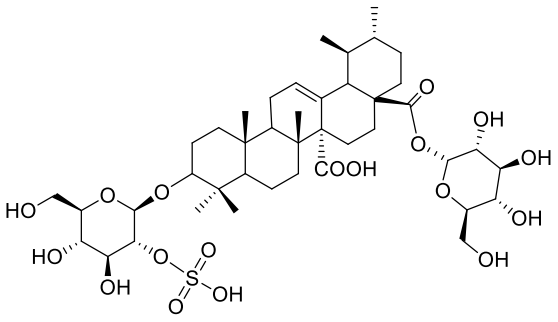
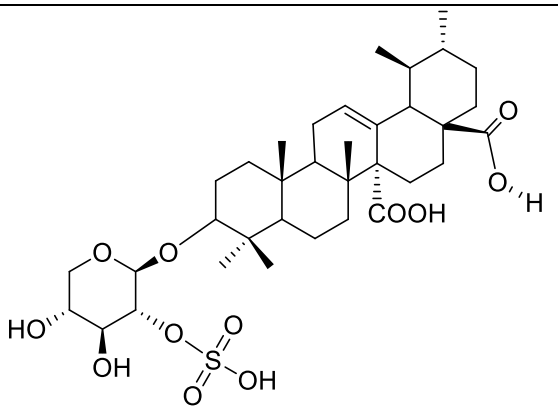
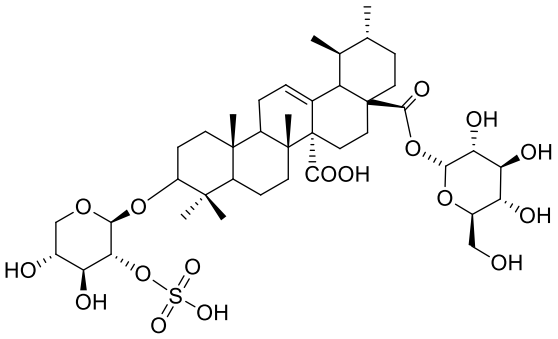
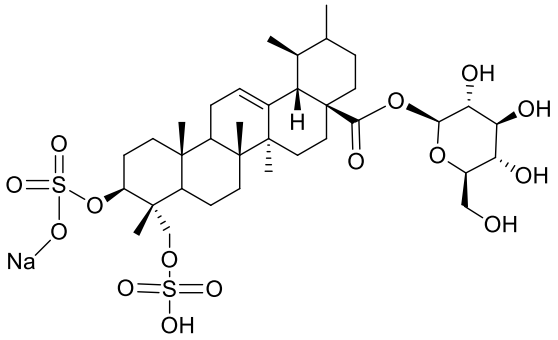
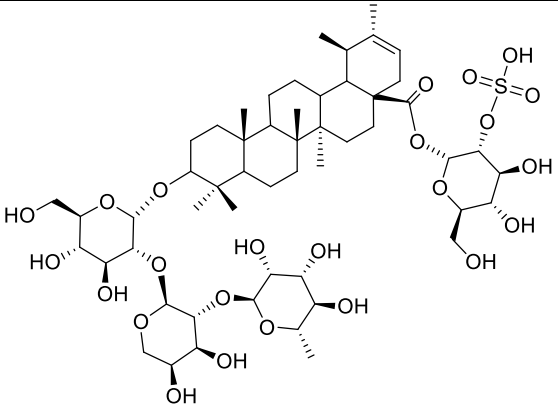
Z. coccineum	3-O-[α-L-arabinopyranosyl-(1→2)-*β*-*D*-quinovopyranosyl] quinovic acid		**(Amin *et al.*, 2010)**	**Aerial**
Z. coccineum	3-O- [*α*-L-arabinopyranosyl-(1→2)-*β*-D-quinovopyranosyl] quinovic acid-28-O-*β*-D-glucopyranosyl ester		**(Amin *et al.*, 2010)**	**Aerial**
Z. aeyptium ***Z. coccineum*** ***Z. propinquum*** ***Z. gaetulum***	Quinovic acid-3-*O*-*β*-*D*-2-O-sulphonylquinovopyranoside Zygophyloside D		**(Zaki *et al.*, 2016)** **(Amin *et al.*, 2010)** **(Ahmad *et al.*, 1993)** **(Belguidoum *et al.*, 2022)**	**Aerial**
Z. album ***Z. aeyptium***	3-*O*-[*β* -D-quinovopyranosyl]-quinovic acid 27-O-[*β* -Dglucopyranosyl] ester		**(Elgamal *et al.*, 1995)** **(Zaki *et al.*, 2016)**	**Aerial**
Z. album ***Z. gaetulum***	3-*O*-[*β* -D-quinovopyranosyl]-quinovic acid		**(Elgamal *et al.*, 1995)** **(Belguidoum *et al.*, 2022)**	**Aerial**

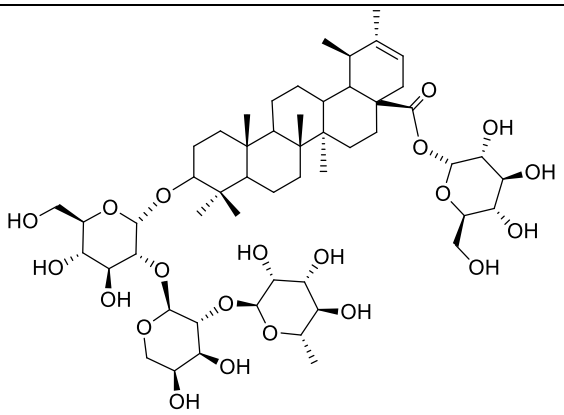
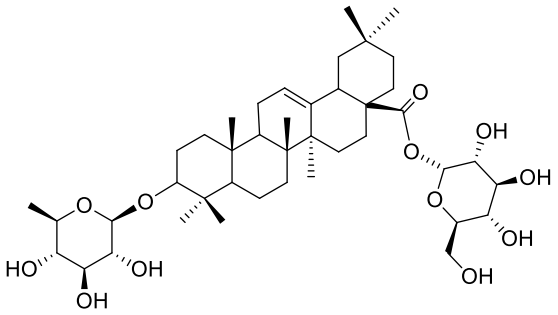
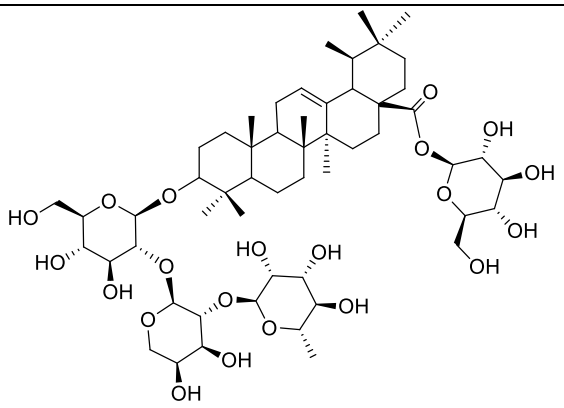
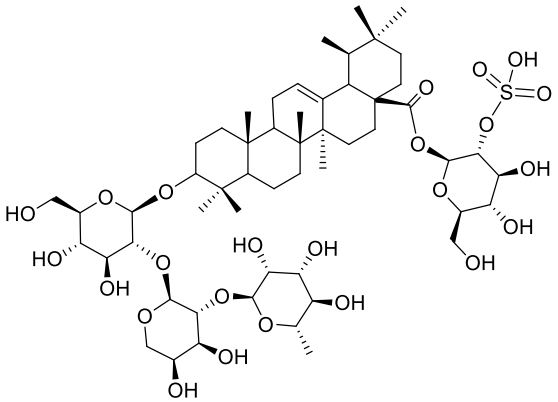
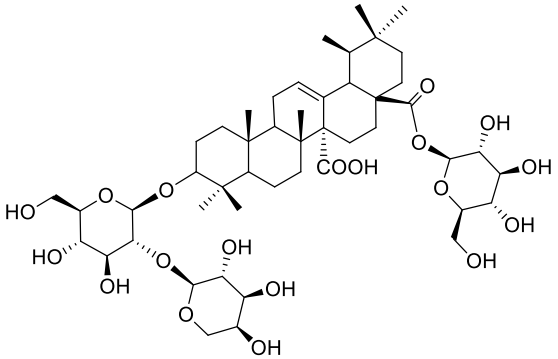
Z. gaetulum	Cincholic acid 3-O-*β*-D-quinovopyranoside		**(Belguidoum *et al.*, 2022)**	**Aerial**
Z. album	14-decarboxyquinovic acid-*0*-(3→ 1)-*a-L-rhamnopyranoside*		**(Hassanean *et al.*, 1989)**	**Aerial**
Z. album	Quinovic acid-(28→1)-*α*-L-rhamnopyranosyl ester		**(Hassanean *et al.*, 1989)**	**Aerial**
Z. album	Quinovic acid-o-(3 → 1)- *α* -L-rhamnopyranoside		**(Hassanean *et al.*, 1989)**	**Aerial**
Z. album ***Z. aeyptium*** ***Z. coccineum*** ***Z. dumosum*** ***Z. melongena*** ***Z. gaetulum***	Quinovic acid-*o*-(3 → 1)- *β* -D-glucopyranoside Quinovic acid-3-O-*β*-D-glucopyranoside		**(Hassanean *et al.*, 1989) (Zaki *et al.*, 2016) (Shawky *et al.*, 2019) (Ganbaatar *et al.*, 2016) (Belguidoum *et al.*, 2022)**	**Aerial**

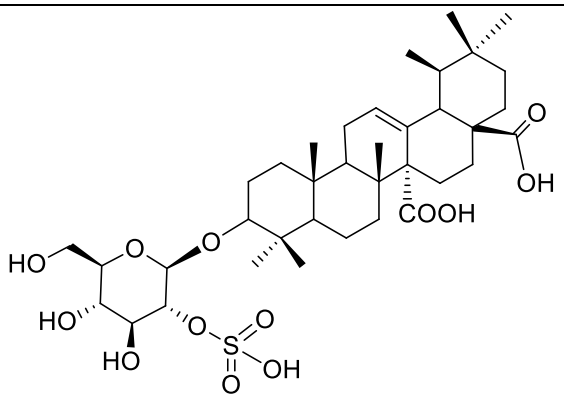
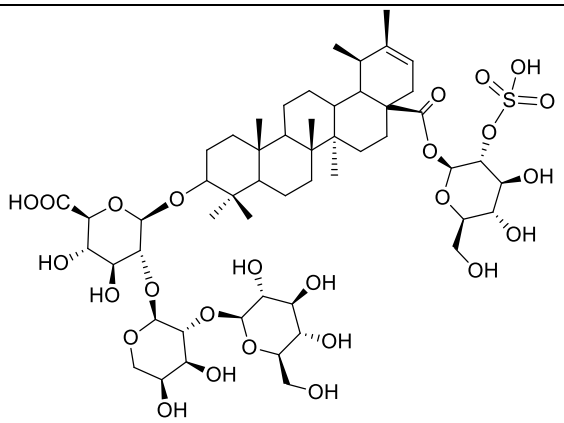
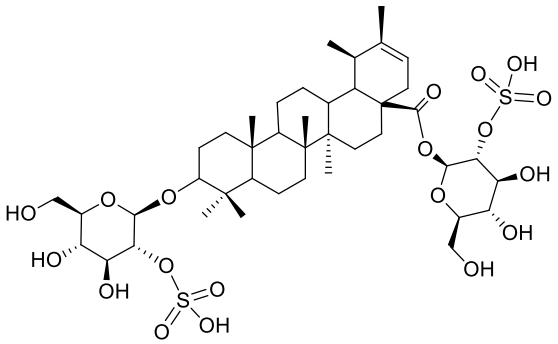
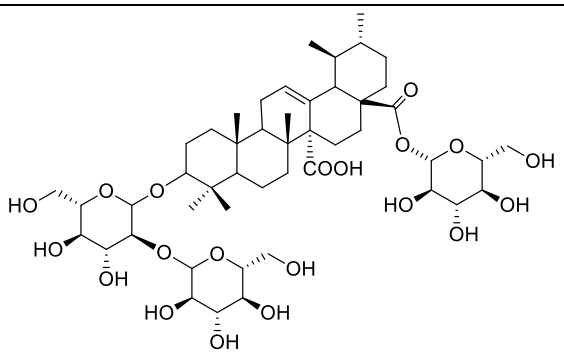
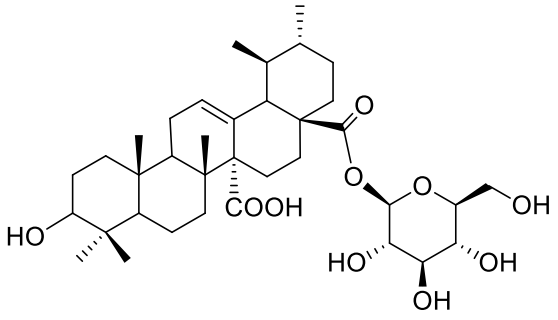
Z. gaetulum	Cincholic acid 3-O-*β*-D-glucopyranoside		**(Belguidoum *et al.*, 2022)**	**Aerial**
Z. album ***Z. aeyptium***	Quinovic acid-3 *β* -O- *β* -D-quinovoside		**(Hassanean *et al.*, 1993a)** **(Elgamal *et al.*, 1995)** **(Zaki *et al.*, 2016)**	**Aerial**
Z. album ***Z. aeyptium*** ***Z. coccineum*** ***Z. fabago*** ***Z. gaetulum***	3- *β*-*O*- *β* -D-quinovopyranosyl quinovic acid (28 → l) *β* -D-glycopyranosyl ester Quinovic acid-3-O-*β*-D-quinovopyranosyl-(28→1)-*β*-D-glucopyranosyl ester		**(Hassanean *et al.*, 1993a)** **(Zaki *et al.*, 2016)** **(Shawky *et al.*, 2019)** **(Belguidoum *et al.*, 2022)**	**Aerial**
Z. gaetulum	3-*O*-*β*-D-quinovopyranosylcincholic acid 28-O-*β*-D-glucopyranosyl ester		**(Belguidoum *et al.*, 2022)**	**Aerial**
Z. aeyptium ***Z. coccineum*** ***Z. fabago*** ***Z. melongena*** ***Z. gaetulum***	Quinovic acid-3-*O*-*β*-D-glucopyranosyl-(28 → 1)-*β*-D-glucopyranosyl ester		**(Zaki *et al.*, 2016)** **(Shawky *et al.*, 2019)** **(Khan *et al.*, 2010)** **(Ganbaatar *et al.*, 2016)** **(Belguidoum *et al.*, 2022)**	**Aerial**

Z. gaetulum	3-*O*-*β*-D-glucopyranosyl cincholic acid 28-*O*-*β*-D-glucopyranosyl ester		**(Belguidoum *et al.*, 2022)**	**Aerial**
Z. aeyptium	quinovic acid-3-[*β*-D-xylopyranosyl (1 → 2)-quinovopyranosyl]-(28 → 1)-*β*-D-glucopyranosyl ester		**(Zaki *et al.*, 2016)**	**Aerial**
Z. album	3 *β*-*O*- *β* -D-quinovopyranosyl(3→ 1) *β* -D-xylopyranoside		**(Hassanean *et al.*, 1993a)**	**Aerial**
Z. album	3 *β*-*O*- *β* -D-quinovopyranosylquinovic acid (28 → l) quinovopyranosy1 ester		**(Hassanean *et al.*, 1993a)**	**Aerial**
Z. atriplicoides (Synonym: Z. eurypterum)	Atriplicosaponin A		**(Ahmad *et al.*, 2005)**	**Whole plant**

Z. atriplicoides (Synonym: Z. eurypterum)	Atriplicosaponin B		**(Ahmad *et al.*, 2005)**	**Whole plant**
Z. eichwaldii	Pomolic acid 3-O-α-L-arabinoside (*Zygophyllum eichwaldii* C)		**(Sasmakov *et al.*, 2001)**	**Root**
Z. eichwaldii	28-O- β- D- glucopyranosyl ester of pomolic acid-3-O-α-L-arabinoside (*Zygophyllum eichwaldii* E)		**(Sasmakov *et al.*, 2001)**	**Root**
Z. eichwaldii	28-O- β -D-glucopyranosyl ester of pomolic acid 3-O- β -D-2-O-sulfonyl-galactopyranoside (*Zygophyllum eichwaldii* I)		**(Sasmakov *et al.*, 2001)**	**Root**
Z. fabago ***Z. gaetulum***	Zygophyloside E		**(Khan *et al.*, 2010) (Safir *et al.*, 1998) (Belguidoum *et al.*, 2022)**	**Aerial**

Z. gaetulum	Zygophyloside G		**(Safir *et al.*, 1998) (Belguidoum *et al.*, 2022)**	**Aerial**
Z. fabago	Zygophylosides O		**(Khan *et al.*, 2010)**	**Aerial**
Z. fabago	Zygophylosides P		**(Khan *et al.*, 2010)**	**Aerial**
Z. fabago	Zygofaboside A		**(Shawky *et al.*, 2019)**	**Aerial**
Z. gaetulum	Zygophyloside I		**(Safir *et al.*, 1998)** **(Belguidoum *et al.*, 2022)**	**Aerial**

Z. gaetulum	Zygophyloside L		**(Safir *et al.*, 1998)**	**Aerial**
Z. gaetulum	Zygophyloside M		**(Safir *et al.*, 1998)**	**Aerial**
Z. gaetulum	3β- O- *α*- L rhamnopyranosyl (1→2) - *α*- L- arabinopyranosyl – (1→2) – *β* – D- glucopyranosyl) urs -20(21)-en-28-oic acid 28-O-[*β* – D-glucopyranosyl] ester		**(Safir *et al.*, 1998)**	**Aerial**
Z. gaetulum	3*β* – O- *α*- L rhamnopyranosyl (1→2) - *α*- L- arabinopyranosyl – (1→2) – *β* – D-glucopyranosylurs -20(21)-en-28-oic acid 28-O-[*β* – D-2-O-sulphonylglucopyranosyl] ester		**(Safir *et al.*, 1998)**	**Aerial**
Z. geslini	3-O-[*α*-L-arabinopyranosyl-(1→2)-*β*-D-glucopyranosyl] quinovic acid 28-(*β*-D-glucopyranosyl) ester		**(Smati *et al.*, 2007)**	**Aerial**

Z. geslini	3-O-[*β*-D-(2-O-sulphonyl) glucopyranosyl] quinovic acid		**(Smati *et al.*, 2007)**	**Aerial**
Z. geslini	(3*β*)-3-{[6-deoxy-*α*-L-mannopyranosyl-(1→2)-*α*-L-arabinopyranosyl (1→2)-*β*-D-glucopyranurosonyl] oxy} urs-20-en-28-oic acid 28-(2-O-sulfo-*β*-D-glucopyranosyl) ester		**(Smati *et al.*, 2007)**	**Aerial**
Z. geslini	3*β*-3-[(2-O-sulfo-*β*-D-glucopyranurosonyl) oxy]-urs-20-en-28-oic acid 28-(2-O-sulfo-*β*-D-glucopyranosyl] ester.		**(Smati *et al.*, 2007)**	**Aerial**
Z. simplex	3-*O*-[*β*-D-glucopyranosyl-(1→2)-*β*-D-glucopyranosyl] quinovic acid-28-)-*O*-*β*-D glucopyranosyl ester		**(Baky *et al.*, 2020)**	**Aerial**
Z. gaetulum	quinovic acid 28-O-*β*-D-glucopyranosyl ester		**(Belguidoum *et al.*, 2022)**	**Aerial**

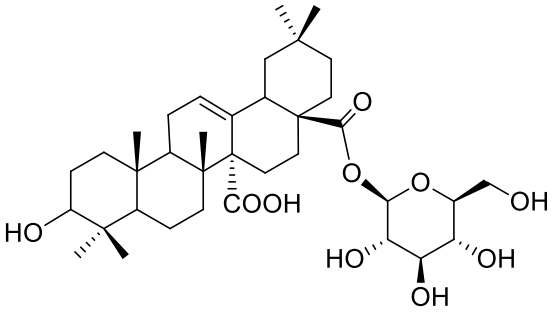
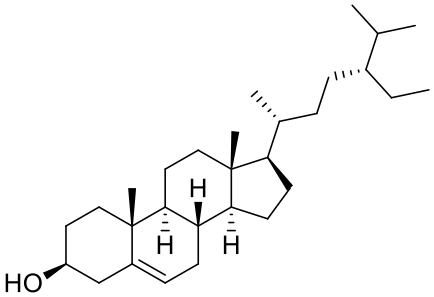
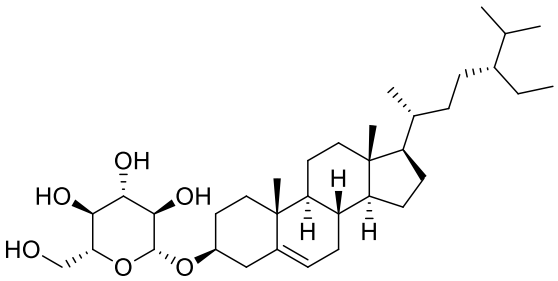
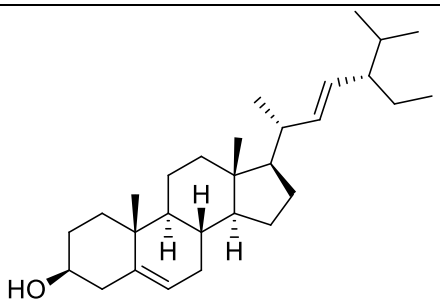
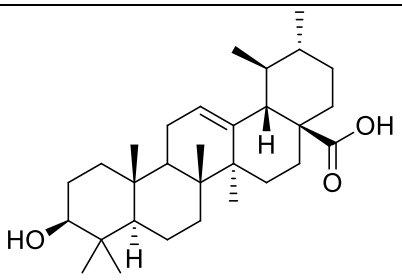
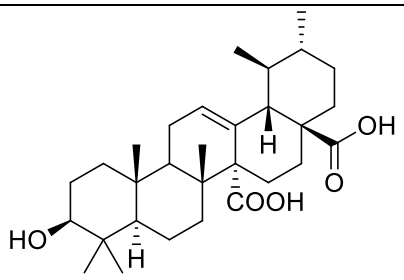
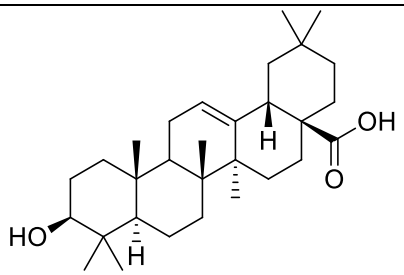
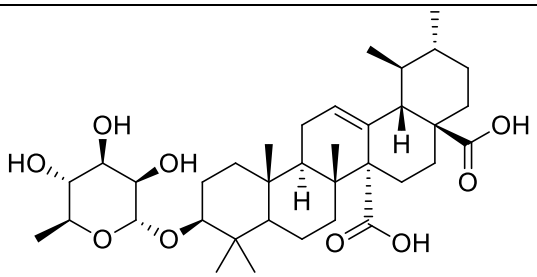
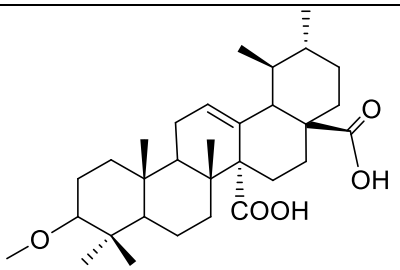
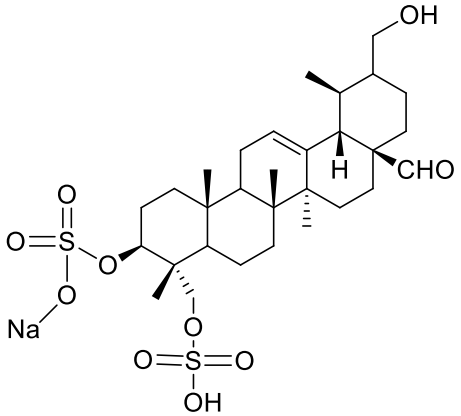
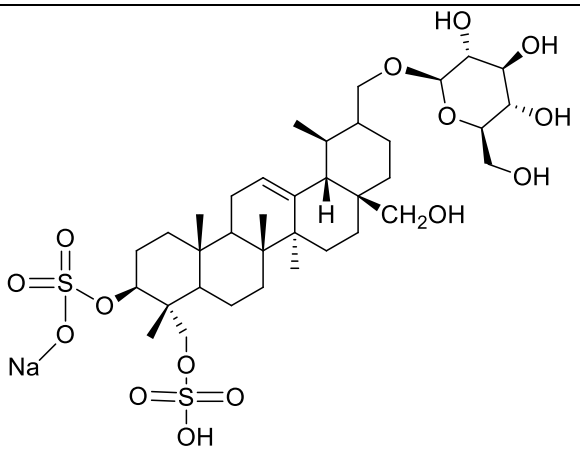
Z. gaetulum	Cincholic acid 28-O-*β*-D-glucopyranosyl ester		**(Belguidoum *et al.*, 2022)**	**Aerial**

Table 3: Sterols and Triterpenoids:

Species	Compound Name	Compound Structure	Reference	Part used
Z. album ***Z. coccienium*** ***Z. cornutum*** ***Z. fabago*** ***Z. simplex***	*β* –sitosterol		**(Shawky *et al.*, 2019) (Abdel-Hamid *et al.*, 2016)**	**Aerial**
Z. album ***Z. atriplicoides*** ***(Synonym: Z. eurypterum)*** ***Z. coccienium*** ***Z. fabago*** ***Z. simplex***	*β* -sitosterol- *β* -D-glucopyranoside		**(Hassanean *et al.*, 1989) (Ahmad *et al.*, 2005) (Shawky *et al.*, 2019) (Abdel-Hamid *et al.*, 2016)**	**Aerial**
Z. album ***Z. coccienium***	Stigmasterol		**(Shawky *et al.*, 2019)**	**Aerial**
Z. album ***Z. coccienium*** ***Z. dumosum*** ***Z. simplex***	Ursolic acid		**(Shawky *et al.*, 2019)**	**Aerial**

Z. simplex	Quinovic acid		**(Baky *et al.*, 2020)**	**Aerial**
Z. album ***Z. coccienium*** ***Z. dumosum*** ***Z. simplex***	Oleanolic acid		**(Shawky *et al.*, 2019)**	**Aerial**
Z. album ***Z. simplex***	quinovic acid 3-*α*-L-rhamnoside		**(Shawky *et al.*, 2019)**	**Aerial**
Z. simplex	3-*O*-methoxy-quinovic acid		**(Baky *et al.*, 2020)**	**Aerial**
Z. fabago	3*β*,4*α* -3,23,30-trihydroxyurs-20-en-28-al 3,23-di(sulfate) sodium salt		**(Khan *et al.*, 2010)**	**Arial**
Z. fabago	3*β*,4*α* -3,23,28-trihydroxyurs-20-en-30-yl *β*-D-glucopyranoside 3,23-di(sulfate) sodium salt		**(Khan *et al.*, 2010)**	**Arial**

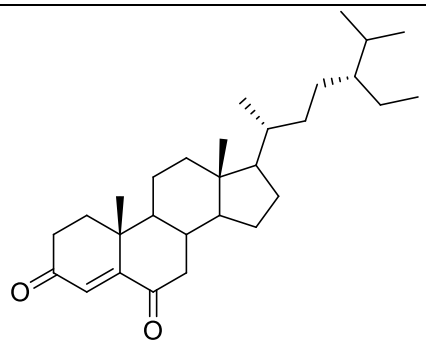
Z. simplex	Stigmast-3,6-dione		**(Amin *et al.*, 2011)**	**Arial**

Table 4: Essential oils:

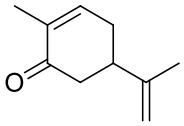
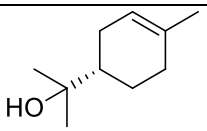
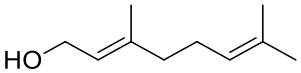
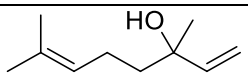
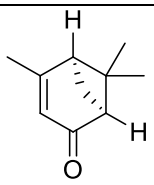
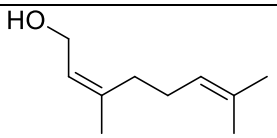
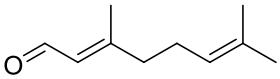
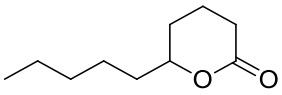
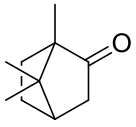
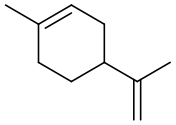
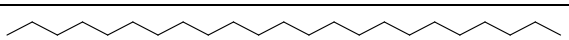
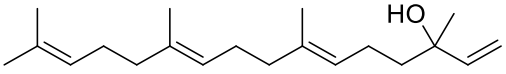
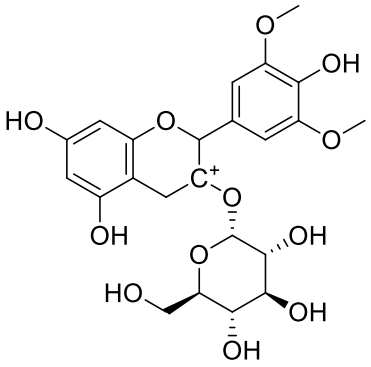
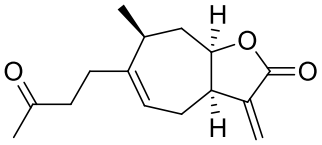
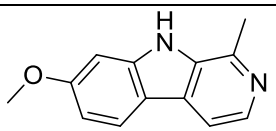
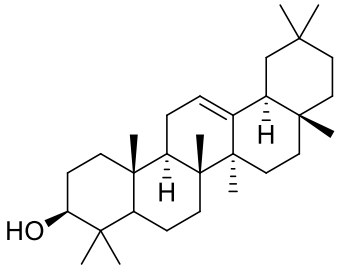
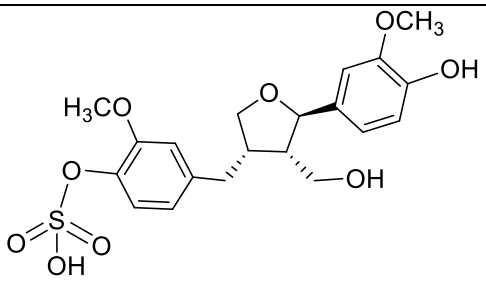
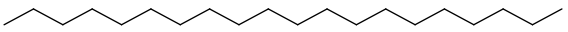
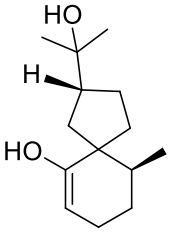
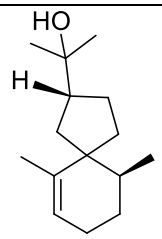
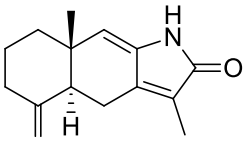
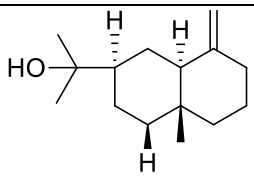
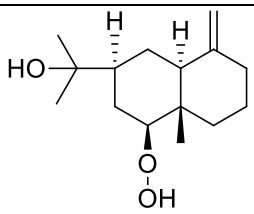
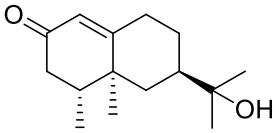
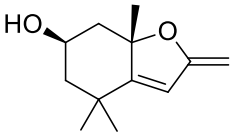
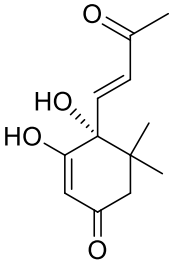
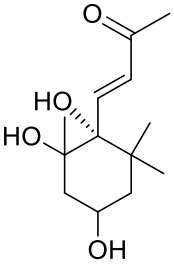
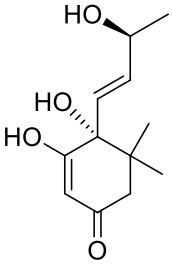
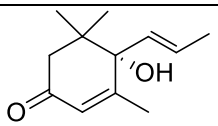
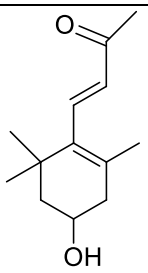
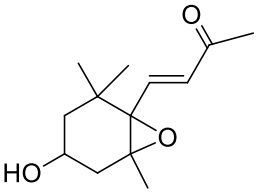
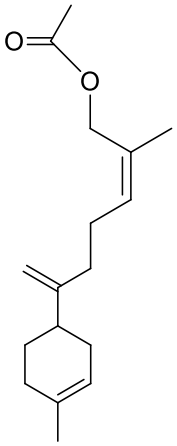
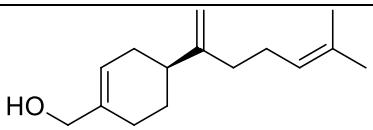
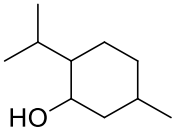
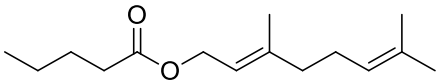
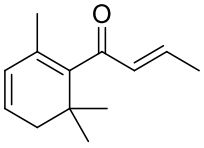
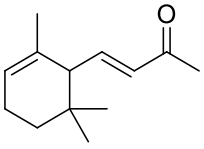
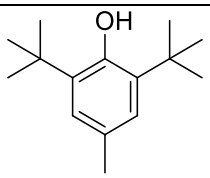
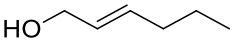
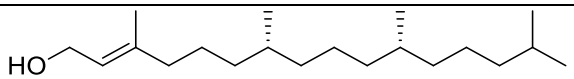
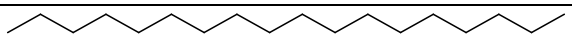
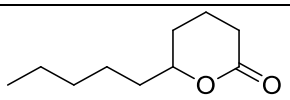
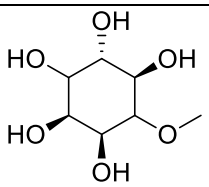
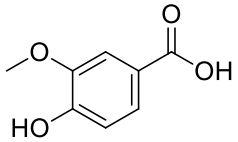
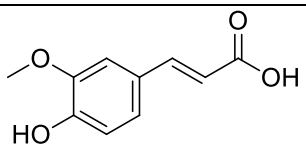
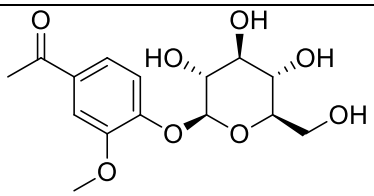
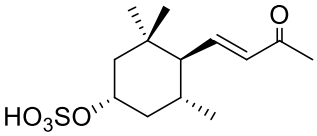
Species	Compound Name	Compound Structure	Reference	Part used
Z. album	Carvone		**(Tigrine-Kordjani,*et al.*, 2010)** **(El Abdouni Khayari,*et al.*, 2017)**	**Fresh leaves**
Z. album ***Z. gaetulum***	*a*-Terpineol			
Z. album	Geraniol			
Z. album ***Z. gaetulum***	Linalool			
Z. album	Verbenone			
Z. album	Nerol			
Z. album	Geranial			
Z. album	d-Decalactone			
Z. album ***Z. gaetulum***	Camphor			
Z. album	Limonene			
Z. album	Tricosane			
Z. fabago	(E, Z)-geranyl linalool		**(Shawky *et al.*, 2019)**	**Aerial**

Table 5: Miscellaneous compounds:

Species	Compound Name	Compound Structure	Reference	Part used
Z. album	Malvidin-3 -Rhamnoside		**(Belmimoun *et al.*, 2017)**	**Aerial**
Z. album	Tomentosin		**(Belmimoun *et al.*, 2017)**	**Aerial**
Z. album	Harmine (β-carboline alkaloid)		**(Shawky *et al.*, 2019)**	**Aerial**
Z. album	β –amyrin		**(Shawky *et al.*, 2019)**	**Aerial**
Z. aeyptium	(7*R*,8*S*,8′*S*)-4,9,4′-trihydroxy-3,3′-dimethoxy-4′-sulfonyl-7,9′-epoxylignan		**(Zaki *et al.*, 2016)**	**Aerial**
Z. fabago ***Z. gaetulum***	Eicosane		**(Shawky *et al.*, 2019) (El Abdouni Khayari,*et al.*, 2017)**	**Aerial**
Z. fabago	1-hydroxyhinesol		**(He *et al.*, 2015)**	**Aerial**

Z. fabago	Hinesol		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	Atractylenolactam		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	β-eudesmol		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	5-*α*-hydroperoxy-*β*-eudesmol		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	11-hydroxy-valenc-1(10)-en-2-one		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	Pubinernoid A		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	(6S,7E)-6-hydroxy-4,7-megastigmadien-3,9-dione		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	(3S,5R, 6S, 7E)-3, 5, 6-trihydroxy-7-megastigmen-9-one		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	(6R,7E,9R)-9-hydroxy-4,7-megastigmadien-3-one		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	Blumenol A		**(He *et al.*, 2015)**	**Aerial**

Z. fabago	(S)-3-hydroxy-beta-ionone		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	3-hydroxy-5-α-6-α-epoxy-beta-ionone		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	Z-lanceol acetate		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	β-bisabolenol		**(Shawky *et al.*, 2019)**	**Aerial**
Z. fabago	Menthol		**(Shawky *et al.*, 2019)**	**Aerial**
Z. fabago	Geranyl valerate		**(Shawky *et al.*, 2019)**	**Aerial**
Z. fabago	(E)-β-damascenone		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	α-inone		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	butylated hydroxyl toluene		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	(E)-2-hexen-1-ol		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	Phytol		**(He *et al.*, 2015)**	**Aerial**
Z. fabago	octadecane		**(He *et al.*, 2015)**	**Aerial**

Z. fabago	σ-deca lactone		**(He *et al.*, 2015)**	**Aerial**
Z. melongena	D-pinitol		**(Ganbaatar *et al.*, 2016)**	**Aerial**
Z. simplex	Vanillic acid		**(Amin *et al.*, 2011)**	**Aerial**
Z. simplex	Ferulic acid		**(Amin *et al.*, 2011)**	**Aerial**
Z. simplex	Androsin		**(Amin *et al.*, 2011)**	**Aerial**
Z. gaetulum	(E)-3-sulfooxymegastigm-7-en-9-one		**(Belguidoum *et al.*, 2022)**	**Aerial**

3- Conclusion:

In this review we have discussed the chemical compounds reported in various species belonging to genus *Zygophyllum*. Our study showed that this genus of is a valuable source of chemically different natural products, especially saponins, triterpenes and flavonoids.

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