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Research Article

A Review: Compounds Isolated From *Cyperus* Species (Part I): Phenolics and Nitrogenous

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ABSTRACT
Species belonging to the family Cyperaceae are an important source of active constituents with biological activity. Cyperaceae is a family of monocotyledonous known as sedges, which superficially resemble grasses or flowering plants rushes. The family comprises about 4000 species described in about 90 genera. These species are widely distributed in tropical Asia and tropical South America. While, sedges may be found growing in all types of soils, many are associated with wet lands or poor soils. The genus *Cyperus* includes about 600 species, some of which are used in folk medicine, the most important one is *Cyperus rotundus* L. In this review we focused on the phenolics and nitrogenous constituents isolated from different *Cyperus* species growing in Egypt.

Keywords: Cyperacae, *Cyperus* species, Phenolics, Nitrogenous compounds.

INTRODUCTION

Family Cyperaceae (Sedge family) includes grass like plants which grow mostly in marshy places. It comprises about 4000 species within 90 genera[1-5]. There are twenty one species of *Cyperus* in Egypt[6]. Many *Cyperus* species are used as food or medicines. The tubers of *C. esculentus* are edible and used as spermatogenic, aphrodisiac, galactogogue, emollient[7], digestive, tonic, diuretic and promotes menstruation[8]. *C. rotundus* L. (Nut grass; Nut sedge, Magessa, Zible El-Meize, Sed El-Homar) [6,7] was well known to the ancient. It grew in Egypt during the stone age in moist soils. Its tubers were used by the ancient Egyptians in embalming and perfumes[9]. Also, they are widely used as diaphoretic, astringent, demulcent, liver remedy, antidysentric, and antimalarial[10], antioxidant, cytotoxic, and α-amylase inhibitory[11,12]. The plant was also used for treatment of cough and psychosomatic diseases[13]. Moreover, rhizomes constituents might be of therapeutic benefit for the prevention of platelet-associated cardiovascular diseases[14]. *C. alopecuroides* Rottb. (Samar; Foxtail Sedge; Mat Sedge, Aloob es-sultaan) is cultivated in some regions of the Nile Delta[6,7]. In Faiyum, it is cultivated in limited areas for mat and chair making[7]. It is used as a raw material for perfumes[15]. The ethanolic extract of the aerial parts of *C. alopecuroides* Rottb. produced signs of pain and allergy on rabbit's skin[16], revealing that the extract contained histamine or histamine like substance[16]. Also, the ethanolic and ethereal extracts of the aerial parts showed antimicrobial activity[16,17]. While, the ethanolic extract of the inflorescences showed a moderate oestrogenic activity[18]. The essential oil displayed significant antimicrobial and cytotoxic activities[15]. Methanolic extract and some isolated compounds of *C. alopecuroides* showed antioxidant, cytotoxic, and α-amylase inhibitory[19]. *C. articulatus* L. are used in the perfume industry[20]. *C. alternifolius* showed signifiant hepatoprotective activity against CCl_4 induced hepatotoxicity in rats[21]. *C. scariosus* have been widely used as anti-inflammatory, analgesic, astringent, hypotensive, hepatoprotective, and antidiabetic[22]. Several reports were traced in the current literature concerning the previous phytochemical studies of different *Cyperus* species. The main phenolics and nitrogenous compounds isolated from different *Cyperus* species are summarized as following table:

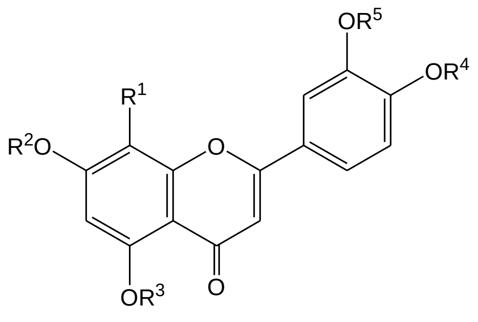
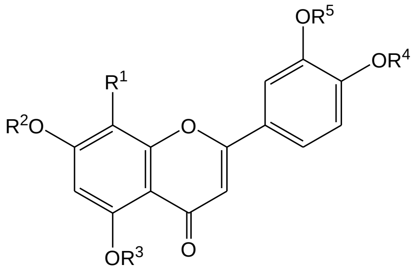


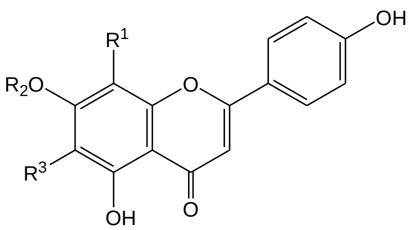
Fig 1: Flavanoids

**Author for Correspondence*

Table 1: Main phenolic constituents isolated from different *Cyperus* species.

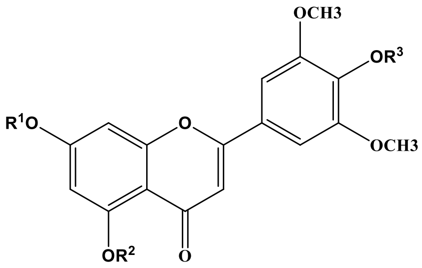
Compound name	Structure	Plant source	Organ	Ref.
1. Flavonoids:				
Luteolin	$R^1 = R^2 = R^3 = R^4 = R^5 = H$	in about 120 species	Leaves and inflorescence	23-27
Luteolin 3`-methyl ether	$R^1 = R^2 = R^3 = R^4 = H$ $R^5 = Me$	*C. rotundus* L.	Tubers and aerial parts	23
Luteolin 4´–methyl ether	$R^1 = R^2 = R^3 = R^5 = H$ $R^4 = Me$	*C. alopecuroides* Rottb.	Inflorescence	[19]
Luteolin 5–methyl ether	$R^1 = R^2 = R^4 = R^5 = H$ $R^3 = Me$	*C. alopecuroides* Rottb.	Leaves	26
		C. aquatilis R. Br.	Leaves and inflorescence	24
		C. alternifolius L.	Leaves	26
		C. articulatus L.	Leaves	26
		C. compressus L.	Leaves and inflorescence	24
		C. conglomeratus Rottb.	Leaves	26
		C. cyperinus Retz.	Leaves	24
		C. disjunctus C.B. Clarke	Leaves and inflorescence	24
		C. fenzelianus	Leaves	26
		C. flaccidus R. Br.	Leaves	24
		C. flavescens L.	Leaves	24
		C. laevigatus L.	Leaves	24,26
		C. lucidus R. Br.	Leaves	24
		C. maculatus Boeck	Leaves	24
		C. polystachyos Rottb.	Leaves	24
		C.reflexus Vahl	Leaves	24
		*C. sanguinolentus*Vahl	Leaves	24
		C. subulatus R. Br.	Leaves	24
		C. tenuiculmis Boeck.	Leaves	24
		C. trinervis R. Br.	Leaves	25
Luteolin 7, 3`-dimethyl ether	$R^1 = R^3 = R^4 = H$ $R^2 = R^5 = Me$	*C. rotundus* L.	Areal parts	[11]
Luteolin 5, 3`-dimethyl ether	$R^1 = R^2 = R^4 = H$ $R^3 = R^5 = Me$	*C. rotundus* L.	Areal parts	[11]
Luteolin 7–glucuronide	$R^1 = R^3 = R^4 = R^5 = H$ R^2 = Glucuronic acid	*C. alternifolius* L.	Leaves	26
		C. bulbosus Vahl	Leaves	26
		C.conglomeratus Rottb.	Leaves	26
		C. compressus L.	Leaves	26
		C. digitatus Roxb.	Leaves	26
		C. difformis L.	Leaves	26

		C. esculentus L.	Leaves	26
		C. fenzelianus	Leaves	26
		C. fuscus L.	Leaves	26
		C. imbricatus R. Br.	Leaves	26
		C. laevigatus L.	Leaves	26
		C. maculatus Boeck	Leaves	26
		C. microbolbos C. B.Cl.	Leaves	26
		C. michelianus L.	Leaves	26
		C. papyrus L.	Leaves	26
		C. rotundus L.	Leaves	11,26
Luteolin 7–glucoside	$R^1 = R^3 = R^4 = R^5 = H$ $R^2 = Glc$	*C. alopecuroides* Rottb.	Leaves	26
		C. articulatus L.	Leaves	26
		C. alternifolius L.	Leaves	26
		C. esculentus L.	Leaves	26
		C. laevigatus L.	Leaves	26
		C. schimperianus Steud.	Leaves	26
Luteolin4`–glucoside	$R^1 = R^2 = R^3 = R^5 = H$ $R^4 = Glc$	*C. rotundus* L.	Areal parts	11
Orientin	$R^1 = Glc$ $R^2 = R^3 = R^4 = R^5 = H$	*C. alopecuroides* Rottb.	Infloresc-ences	28
Luteolin 7–diglucoside	$R^1 = R^3 = R^4 = R^5 = H$ $R^2 = Glc–Glc$	*C. alopecuroides* Rottb.	Leaves	26
		C. bulbosus Vahl	Leaves	26
		C. difformis L.	Leaves	26
		C. esculentus L.	Leaves	26
		C. maculatus Boeck.	Leaves	26
		C. michelianus L.	Leaves	26
		C. rotundus L.	Leaves	26
		C. schimperianus Steud.	Leaves	26
Luteolin 7–rutinoside	$R^1 = R^3 = R^4 = R^5 = H$ $R^2 = Rham (1\rightarrow6) Glc$	*C. articulatus* L.	Leaves	26
Luteolin 7–glucuronide –4`–glucoside	$R^1 = R^3 = R^5 = H$ $R^2 = Glucuronic\ acid$ $R^4 = Glc$	*C. laevigatus* L.	Leaves	26

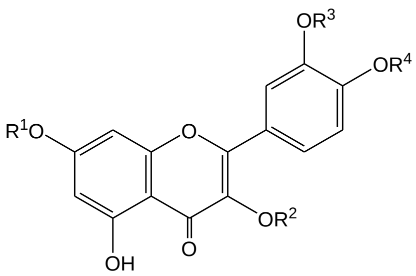


Apigenin	$R^1 = R^2 = R^3 = H$	*C. bulbosus* Vahl	Leaves	24
		C. bowmanii Benth.	Leaves	24
		C. compressus L.	Leaves	24
		C. castaneus (Willd.)	Leaves	24
		C. cuspidatus H. B. K.	Leaves	24
		C. enervis R. Br.	Leaves	25
		C. nervulosus (KÜK.)	Leaves	24
		C. perangustus T. S. Blake.	Leaves	24
		C. sulicinux C.B.Clarke	Leaves	24
Apigenin 7–glucoside	$R^1 = R^3 = H$, $R^2 = Glc$	*C. laevigatus* L.	Leaves	26

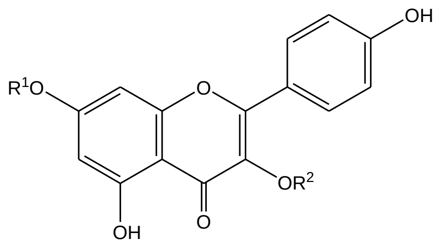
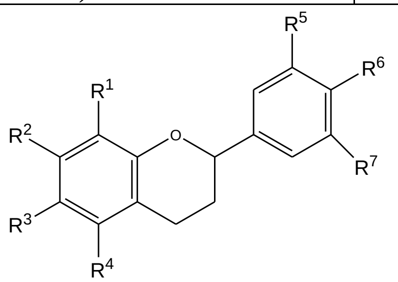
Apigenin 7–glucuronide	R^2 = Glucuronic acid $R^1 = R^3$ = H	*C. laevigatus* L.	Leaves	26
Vicenin 2	$R^1 = R^3$ = Glc, R^2 = H	*C. alopecuroides Rottb.*	Inflorescences	19

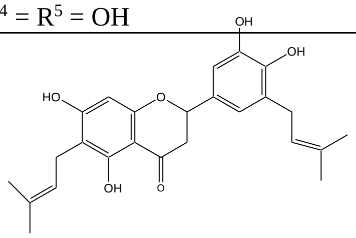
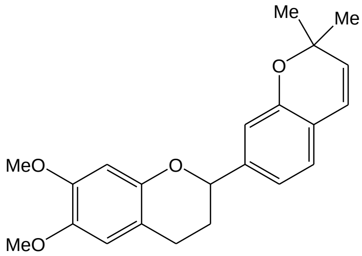
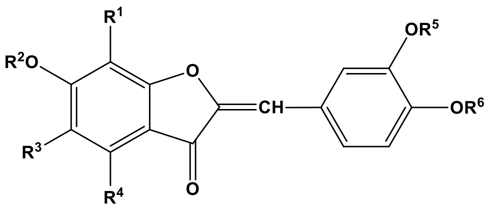


Tricin	$R^1 = R^2$ = H, R^3 = Me	in about 90 species	Leaves and inflorescences	24,25
Tricin 5–glucoside	R^1 = H, R^2 = Glc R^3 = Me	*C. alopecuroides* Rottb. *C. difformis* L. *C. digitatus* Roxb. *C. fenzelianus* *C. maculatus* Boeck *C. rotundus* L.	Leaves Leaves Leaves Leaves Leaves Leaves	26 26 26 26 26 26
Tricin 5–diglucoside	R^1 = H R^2 = Glc – Glc, R^3 = Me	*C. laevigatus* L.	Leaves	26
Tricin 7–glucoside	R^1 = Glc, R^2 = H R^3 = Me	*C. alopecuroides* Rottb. *C. michelianus* L.	Leaves Leaves	26 26
Tricin 7–glucuronide	R^1 = Glucuronic acid R^2 = H, R^3 = Me	*C. conglomeratus* Rottb. *C. laevigatus* L.	Leaves Leaves	26 26
Tricin 7–diglucoside	R^1 = Glc – Glc R^2 = H, R^3 = Me	*C. bulbosus* Vahl *C. digitatus* Roxb. *C. fenzelianus* *C. laevigatus* L. *C. michelianus* L.	Leaves Leaves Leaves Leaves Leaves	26 26 26 26 26
Tricin 7,4`–diglucoside	$R^1 = R^3$ = Glc, R^2 = H	*C. laevigatus* L.	Leaves	26

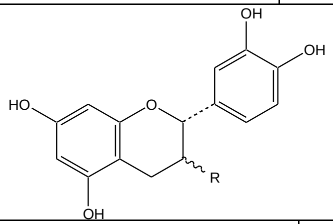


Quercetin	$R^1 = R^2 = R^3 = R^4$ = H	*C. aquatilis* R. Br. *C. brevifolius* Rottb. *C. flaccidus* R. Br. *C. haspan* L. *C. leavis* R. Br. *C. prolifer* Lam. *C. squarrosus* L. *C. tenuispica* Steud. *C. tenuiculmis* Boeck *C. rotundus* L.	Leaves Leaves Leaves Leaves Leaves Leaves Leaves Leaves Leaves Aerial parts	24 24 24 24 24 24 24 24 24 23

Quercetin 3–methyl ether	$R^1 = R^3 = R^4 = H$ $R^2 = Me$	*C. cunninghamii* C. Clarke *C. dactylotes* Benth. *C. rigidellus* Benth. *C. tetraphyllus* R. Br.	Leaves Leaves Leaves Leaves Leaves	24 24 24 24 24
Quercetin 3,7–dimethyl ether	$R^1 = R^2 = Me$ $R^3 = R^4 = H$	*C. dactylotes* Benth. *C. rigidellus* Benth.	Leaves Leaves	24 24
Quercetin 3,7,3`–tri-methyl ether	$R^1 = R^2 = R^3 = Me$, $R^4 = H$	*C. dactylotes* Benth. *C. rigidellus* Benth.	Leaves Leaves	24 24
Quercetin 3,3´–dimethyl ether	$R^1 = R^4 = H$ $R^2 = R^3 = Me$	*C. alopecuroides* Rottb.	Infloresc-ences	19
Quercetin 3,4´–dimethyl ether	$R^1 = R^3 = H$ $R^2 = R^4 = Me$	*C. alopecuroides* Rottb.	Infloresc-ences	19
Quercetin 3–rutinoside	$R^1 = R^3 = R^4 = H$ R^2 = Rham (1→6) Glc	*C. alopecuroides* Rottb. *C. rotundus* L.	Leaves Aerial parts	[26] [23]
Rhamnetin 3–*O*–rhamnosyl (1→4) rhamno-pyranoside	$R^1 = Me$, $R^3 = H$ R^2 = rham (1→4) rham.	*C. rotundus* L.	Mature tubers	28
				
Kaempferol	$R^1 = R^2 = H$	*C. rotundus* L.	Tubers and aerial parts	23
Kaempferol 3–methyl ether	$R^1 = H$, $R^2 = Me$	*C. dactylotes* Benth. *C. cunninghamii* C. Clarke *C. sexflorus* R. Br. *C. tetraphyllus* R. Br.	Leaves Leaves Leaves Leaves Leaves	24 24 24 24 24
Kaempferol 3,7–dimeth ylether	$R^1 = R^2 = Me$	*C. dactylotes* Benth. *C. cunnirghamii* C. B. Clarke *C. rigidellus* Benth.	Leaves Leaves Leaves Leaves	24 24 24 24
Kaempferol 3–*O*-*β*–D–(2^G-glucosylrutinoside)	$R^1 = H$, R^2 = *O*-β–D–(2G-glucosylrutinoside)	*C. alopecuroides* Rottb.	Aerial parts	19
Kaempferol 3-*O*-*β*–D–(2G-xylosylrutinoside)	$R^1 = H$, R^2 = -*O*-β–D–(2G-xylosylrutinoside)	*C. alopecuroides* Rottb.	Aerial parts	19
				
5,7,4`–Trimethoxy–6–prenyl flavan	$R^1 = R^5 = R^7 = H$ $R^2 = R^4 = R^6 = OMe$ $R^3 = CH_2CH{=}C(CH_3)_2$	*C. conglomeratus* Rottb.	Whole plant	29
5,7-Dihydroxy–3`,5`-	$R^1 = R^6 = H$, $R^2 = R^4 = OH$	*C. conglomeratus*	Tubers	30

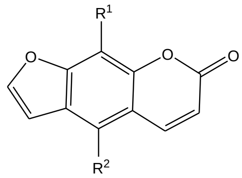
dimethoxy–6–prenylflavan	$R^3 = CH_2CH=C(CH_3)_2$, $R^5 = R^7 = OMe$	Rottb.		
7,3`-Dihydroxy-5,5`-dimethoxy-8-prenylflavan	$R^1 = CH_2CH=C(CH_3)_2$, $R^2 = R^5 = OH$, $R^3 = R^6 = H$, $R^4 = R^7 = OMe$	*C. conglomeratus* Rottb.	Whole plant	31
5,7,3`-Trihydroxy-5`-methoxy-8-prenylflavan	$R^1 = CH_2CH=C(CH_3)_2$ $R^2 = R^4 = R^5 = OH$, $R^3 = R^6 = H$, $R^7 = OMe$	*C. conglomeratus* Rottb.	Whole plant	31
5-Hydroxy-7, 3`, 5`- tri-methoxyflavan	$R^1 = R^3 = R^6 = H$, $R^2 = R^5 = R^7 = OMe$, $R^4 = OH$	*C. conglomeratus* Rottb.	Tubers	30
5,3´-Dihydroxy-6,4´-dimethoxyflavan	$R^1 = R^2 = R^7 = H$, $R^3 = R^6 = OMe$ $R^4 = R^5 = OH$	*C. capitatus* Vand.	Rhizomes	32
5,7,4´,5´-Tetrahydroxy-6,3´-diprenylflavanone		*C. capitatus* Vand.	Rhizomes	32
		*C. conglomeratus* Rottb.	Tubers	33
				
Aureusidin (4,6,3`,4`-Tetrahydroxy aurone)	$R^1 = R^2 = R^3 = R^5 = R^6 = H$, $R^4 = OH$	in about 60 species	Fruits, leaves and inflorescences	24–26
Sulphuretin (6,3`,4`–Trihydroxyauron e)	$R^1 = R^2 = R^3 = R^4 = R^5 = R^6 = H$	*C. alopecur-oides* Rottb. *C. capitatus* Vand. *C. fuscus* L. *C. michelia-nus* L.	Leaves Leaves Leaves Leaves	26 26 26 26
Leptosidin–6–*O*–*β*-D–glucopyranosyl–*O*–*α*–L–rhamnopyranoside	$R^1 = OMe$ $R^2 =$ Glc (1→4) rham. $R^3 = R^4 = R^5 = R^6 = H$	*C. scariosus* R. Br.	Leaves	34
Mariscetin (7–Hydroxyaureusidin)	$R^1 = R^4 = OH$ $R^2 = R^3 = R^5 = R^6 = H$	in about 19 species	Inflorescences	24
6,3`,4`–Trihydroxy–4–me thoxy–5–methylaurone	$R^1 = R^2 = R^5 = R^6 = H$ $R^3 = Me$, $R^4 = OMe$	*C. capitatus* Vand.	Rhizomes and roots	35
6,3`–Dihydroxy–4, 4`–dimethoxy–5–methylauro ne	$R^1 = R^2 = R^5 = H$ $R^3 = R^6 = Me$ $R^4 = OMe$	*C. capitatus* Vand.	Rhizomes and roots	36
4,6,3`,4`–Tetramethoxy aurone	$R^1 = R^3 = H$ $R^2 = R^5 = R^6 = Me$	*C. capitatus* Vand.	Rhizomes and roots	36

	R^4 = OMe			
4,6,3`,4`–Tetrahydroxy –5–methylaurone	$R^1 = R^2 = R^5 = R^6$ = H, R^4 = OH, R^3 = Me	*C. capitatus* Vand.	Rhizomes and roots	37
4,6,3`,4`–Tetrahydroxy–7 –methylaurone	R^1 = Me $R^2 = R^3 = R^5 = R^6$ = H, R^4 = OH	*C. capitatus* Vand.	Rhizomes and roots	37
6, 3`, 4`–Trihydroxy–4–methoxy–7–methyl aurone	R^1 = Me $R^2 = R^3 = R^5 = R^6$ = H, R^4 = OMe	*C. capitatus* Vand.	Rhizomes and roots	37

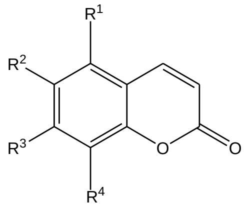


(+) Catechin	R = β-OH	*C. longus* L.	Whole plant	27
(-) Epicatechin	R = α-OH	*C. longus* L.	Whole plant	27

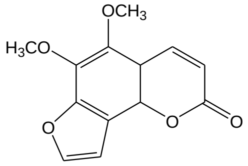
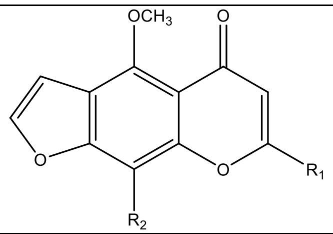
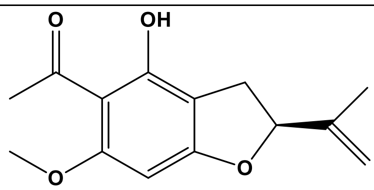
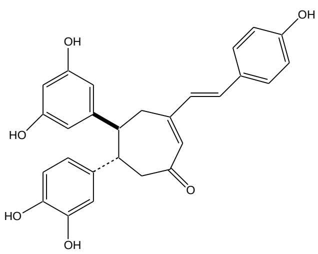
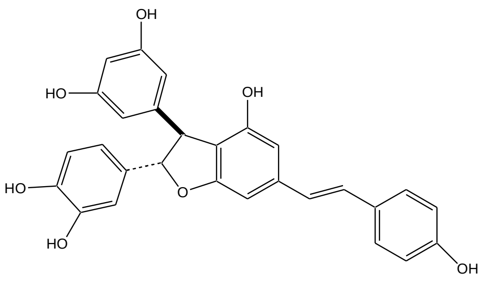
2. Coumarins:

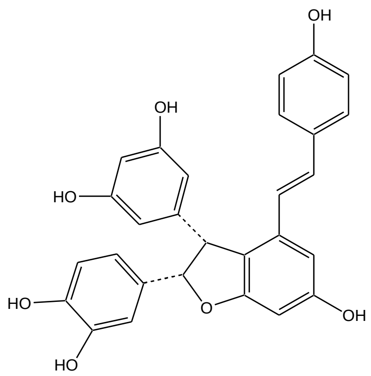
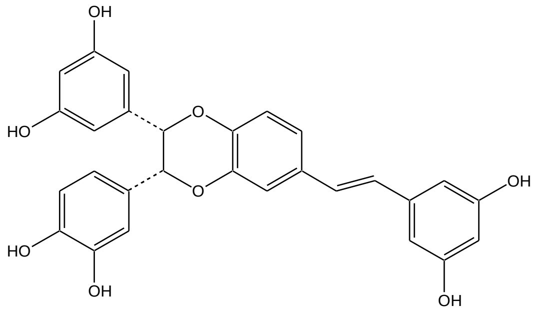
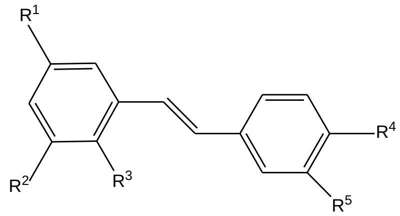
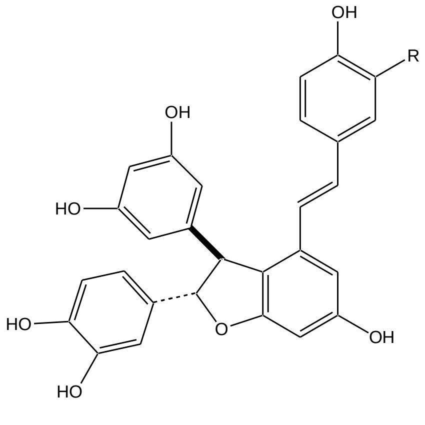


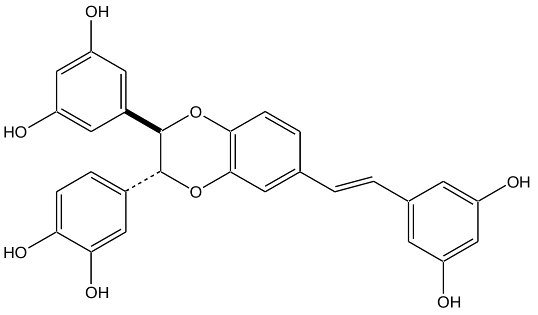
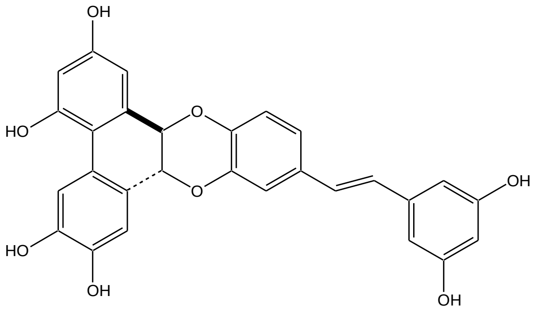
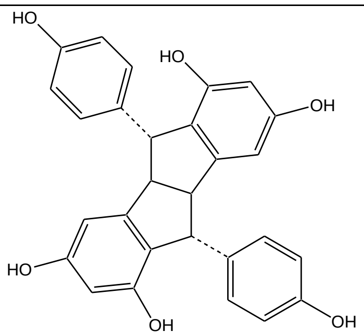
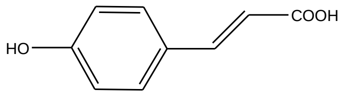
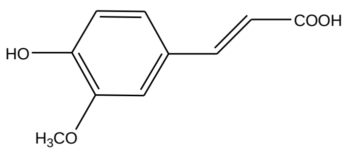
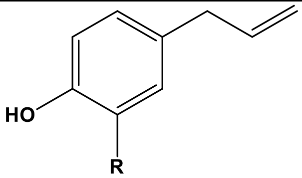
Imperatorin	R^1 = O-$CH_2CH=C(CH_3)_2$ R^2 = H	*C. alopecuroides* Rottb.	Aerial parts	18
Bergapten	R^1 = H, R^2 = OMe	*C. alopecuroides* Rottb.	Aerial parts	18
Xanthotoxin	R^1 = OMe, R^2 = H	*C. alopecuroides* Rottb.	Aerial parts	18
Xanthotoxol	R^1 = OH, R^2 = H	*C. alopecuroides* Rottb.	Aerial parts	18

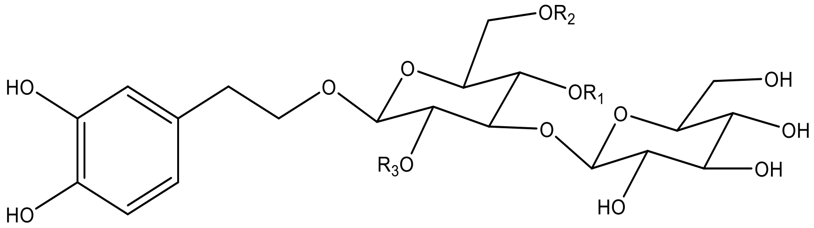
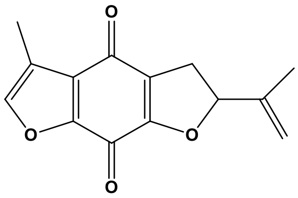
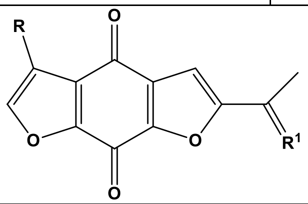


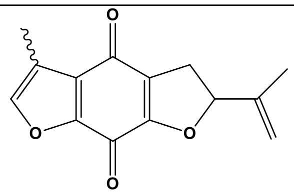
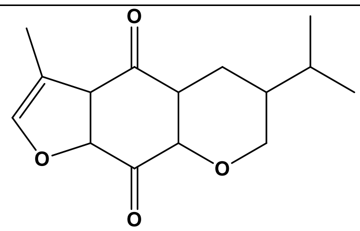
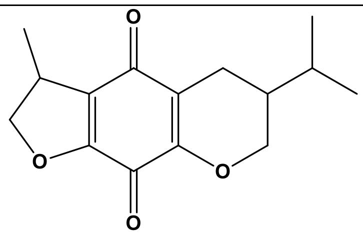
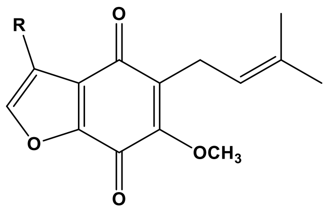
Isoscopoletin	$R^1 = R^4$ = H, R^2 = OH R^3 = OMe	*C. alopecuroides* Rottb.	Aerial parts	18
Esculetin	$R^1 = R^4$ = H $R^2 = R^3$ = OH	*C. alopecuroides* Rottb.	Aerial parts	18
Umbelliferone	$R^1 = R^2 = R^4$ = H R^3 = OH	*C. incompletus*	-	38
Scopoletin	$R^1 = R^4$ = H R^2 = OMe, R^3 = OH	*C. incompletus*	-	38
5,7-Dimethoxycoumarin	$R^1 = R^3$ = OMe $R^2 = R^4$ = H	*C. incompletus*	-	38
7,8-Dimethoxycoumarin	$R^1 = R^2$ = H $R^3 = R^4$ = OMe	*C. incompletus*	-	38
5,7,8-Trimethoxycoumarin	$R^1 = R^3 = R^4$ = OMe R^2 = H	*C. incompletus*	-	38

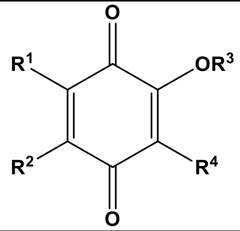
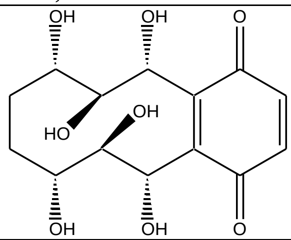
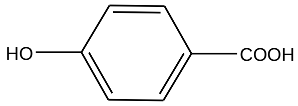
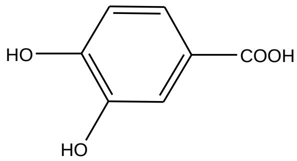
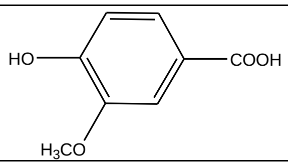
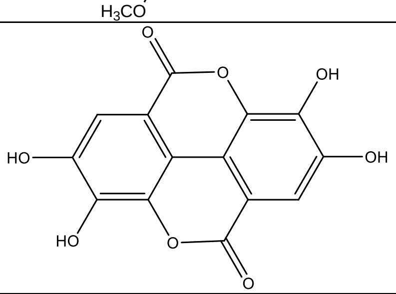
Leptodactylone	$R^1 = R^3 = OMe$, $R^2 = H$, $R^4 = OH$	*C. incompletus*	-	38
Prenyletin	$R^1 = R^4 = H$, $R^2 = OH$ $R^3 = -OCH_2CH{=}C(CH_3)_2$	*C. incompletus*	-	38
5,7-Dimethoxy-8-(*γ,γ*-Dimethylallyloxy) coumarin	$R^1 = R^3 = OMe$, $R^2 = H$ $R^4 = -OC(CH_3)_2CH{=}CH_2$	*C. incompletus*	-	38
7-Methoxy-8-(*γ,γ*-dimethylallyloxy) coumarin	$R^1 = R^2 = H$, $R^3 = OMe$ $R^4 = -OC(CH_3)_2CH{=}CH_2$	*C. incompletus*	-	38
7-(γ,*γ*-Dimethylallyloxy) 8-methoxycoumarin	$R^4 = OMe$, $R^1 = R^2 = H$ $R^3 = -OC(CH_3)_2CH{=}CH_2$	*C. incompletus*	-	38
Pimpinellin		*C. papyrus*	-	39
3. Chromones:				
		*C. rotundus* L.	Aerial parts	23
Khellin	$R_1 = R_2 = CH_3$	*C. rotundus* L.	Aerial parts	11
Visnagin	$R_1 = CH_3$, $= R_2 = H$	*C. rotundus* L.	Aerial parts	11
Ammiol	$R_1 = CH_2OH$, $= R_2 = CH_3$	*C. rotundus* L.	Aerial parts	11
Khellol-*β*-D-glucopyranoside	$R_1 = CH_2O$-glu, $= R_2 = H$	*C. rotundus* L.	Aerial parts	11
4. Coumarans:				
Remirol		*C. nipponicus*	Basal and aerial stems	40
5. Stilbenoids:				
Longusone A		*C. longus* L.	Whole plant	27
Longusol A		*C. longus* L.	Whole plant	27

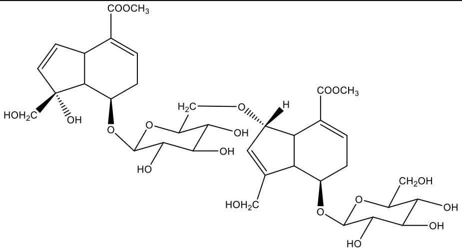
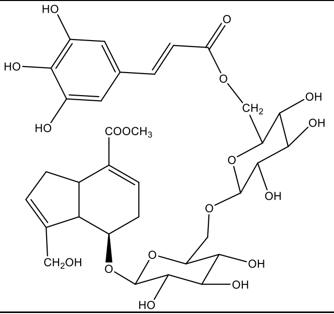
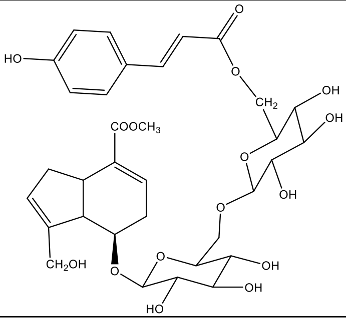
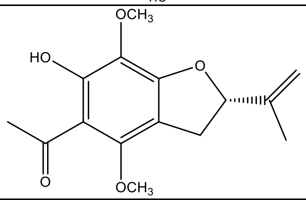
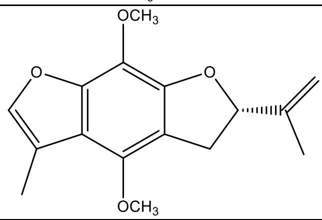
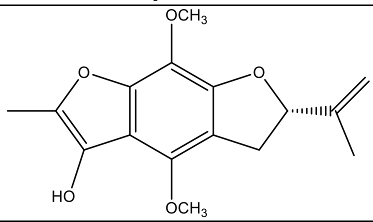
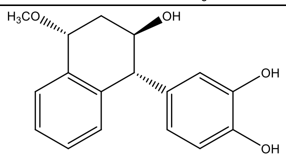
Longusol B		*C. longus* L.	Whole plant	27
Longusol C		*C. longus* L.	Whole plant	27
				
3,5, 3´,4´-Tetramethoxystilbene	$R^1 = R^2 = R^4 = R^5 = OMe, R^3 = H$	*C. capitatus* Vand.	Rhizomes	31
Resveratrol	$R^1 = R^2 = R^4 = OH, R^3 = R^5 = H$	*C. longus* L.	Whole plant	27
Piceatannol	$R^1 = R^2 = R^4 = R^5 = OH, R^3 = H$	*C. longus* L.	Whole plant	27
2-Prenyl-3,4`-dihydroxy-5-methoxy stilbene	$R^1 = H, R^2 = R^4 = OH$ $R^3 = CH_2{=}CHC(CH_3)_2, R^5 = OMe$	*C.conglomer-atus* Rottb.	Tubers	33
				
Trans- Scirpusin A	R = H	*C. longus* L.	Whole plant	27
Trans- Scirpusin B	R = OH	*C. longus* L.	Whole plant	27

Cassigarol E		*C. longus* L.	Whole plant	27
Cassigarol G		*C. longus* L.	Whole plant	27
Pallidol		*C. longus* L.	Whole plant	27
6. Phenylpropanoids:				
p-Coumaric acid		*C. rotundus* L.	Tubers	41
Ferulic acid		*C. rotundus* L.	Tubers	41
				
4–Hydroxyallylbenzene	R = H	*C. conglomeratus* Rottb.	Tubers	29
3–Ethoxy–4–hydroxyallylbenzene	R = OEt	*C. conglomeratus* Rottb.	Tubers	29

				
Isoaragoside	R_1 = H: R_2 = caffeoyl; R_3 = Ara	*C. rotundus* L.	Rhizomes	42
Chionoside A	R_1 = Feruloyl: R_2 = H; R_3 = Ara	*C. rotundus* L.	Rhizomes	42
Helioside C	R_1 = Feruloyl: R_2 = Xyl; R_3 = Ara	*C. rotundus* L.	Rhizomes	42
<u>7. Quinones</u>: Dihydrocyperaquinone		*C. haspan* L. C. *alopecuroides* Rottb. C. *alternifolius* L. C. *platystylis* R. Br.	Root and rhizomes Root and rhizomes Roots and rhizomes Roots and rhizomes	43 44 44 43
				
Cyperaquinone	R = Me, R^1 = CH_2	*C. aristatus* Rottb.	Roots and rhizomes	44
		C. conicus (R. Br.) Boeck	Roots and rhizomes	44
		C. decompositus (R. Br.) F. Muell.	Roots and rhizomes	44
		C. exaltatus Retz.	Roots and rhizomes	44
		C. eragrostis Lam.	Roots and rhizomes	44
		C. haspan L.	Roots and rhizomes	44
		C. javanicus Houtt.	Roots and rhizomes	44
		C. nipponicus	Basal stems	40
		C. pilosus Vahl	Roots and rhizomes	43
		C. subulatus R. Br.	Roots and rhizomes	44
		C. vaginatus R. Br.	Roots and rhizomes	44
Demethylcyperaquinone	R = H, R^1 = CH_2	*C. aristatus* Rottb. *C. compressus* L.	Roots and rhizome Roots and rhizome	43 44
Hydroxycyperaquinone	R = CH_2OH, R^1 = CH_2	*C. conicus* (R. Br.) Boeck	Roots and rhizomes	44
		C. cyeroides (L.) O. Ktzetl	Roots and rhizomes	44

		C. decompositus (R. Br.) F. Muell.	Root and rhizomes	44
		C. eragrostis Lam.	Roots and rhizomes	44
		C. haspan L.	Roots and rhizomes	44
		C. javanicus Houtt.	Roots and rhizomes	44
		C. stoloniferus Retz.	Roots and rhizomes	44
		C. subulatus R. Br.	Roots and rhizomes	44
		C. vaginatus R. Br.	Roots and rhizomes	44
Conicaquinone	R = Me, R^1 = O	*C. conicus* (R. Br.) Boeck	Roots and rhizomes	44
Tetrahydrocyperaquinone		*C. alternifolius* L.	Roots and rhizomes	44
Scabiquinone		*C. distans* L.	Roots and rhizomes	40,44
		C. eleusinoides Künth	Roots and rhizomes	44
		C. scaber (R. Br.) Boeck	Roots and rhizomes	44
Dihydroscabequinone		*C. distans* L.	Roots and rhizomes	44
		C. scaber (R. Br.) Boeck	Roots and rhizomes	44
				
Breviquinone	R = Me	*C. dietricheae var. brevibracteatus* (Domin) kükenth.	Roots and rhizomes	44

Hydroxybreviquinone	R = CH_2OH	*C. dietricheae var. brevibracteatus* (Domin) kükenth.	Roots and rhizomes	44
 				
Hydroxydietrichequin-one	$R^1 = CH_3 – (CH_2)_7 – CH=CH – (CH_2)_7$ R^2 = OH, R^3 = Me, R^4 = H	*C. aff. dactylotes* Benth. *C. decompositus* (R. Br.) F. Muell. *C. dietricheae* Boeck *C. fulvus* R. Br. *C. javanicus* *C. rutilans* (C. B. clarke) Maiden & Betche.	Roots and rhizomes Roots and rhizomes Roots and rhizomes Roots and rhizomes - Roots and Rhizomes	44 43 44 44 43 44
Capiquinones A–K	$R^1 = C_{17}H_{35}$ and increasing by CH_2 to $C_{27}H_{55}$ $R^2 = R^3$ = H, R^4 = Me	*C. capitatus* Vand.	Under-ground organs	44-46
Alopecuquinone	 	*C. alopecuroides* Rottb.	Inflorescen-ces	27
7. Phenolic acids:				
P-Hydroxybenzoic acid	 	*C. rotundus* L.	Tubers	41
Protocatechuic acid	 	*C. rotundus* L.	Tubers	41
Vanillic acid	 	*C. rotundus* L.	Tubers	41
Ellagic acid	 	*C. rotundus* L.	Aerial parts	12

8. Iridoides, benzodihydrofurans, and miscileanous:				
Rotunduside A		*C. rotundus* L.	Rhizomes	42
Rotunduside B		*C. rotundus* L.	Rhizomes	42
6``-*O*-*p*-Coumaroylgenipin gentiobioside		*C. rotundus* L.	Rhizomes	42
1-[2,3-Dihydro-6-hydroxy-4,7-dimethoxy-2S-(prop-1-en-2-yl)benzofuran-5-yl]ethanone		*C. rotundus* L.	Rhizomes	47
2*S*-Isopropenyl-4,8-dimethoxy-5-methyl-2,3-dihydrobenzo-[1,2-b;5,4-b`]difuran		*C. rotundus* L.	Rhizomes	47
2*S*-Isopropenyl-4,8-dimethoxy-5-hydroxy-6-methyl-2,3-dihydrobenzo[1,2-b;5,4-b`]difuran		*C. rotundus* L.	Rhizomes	47
1α-Methoxy-3β-hydroxy-4α-(3′,4′-dihydroxyphenyl)-1,2,3,4-tetrahydronaphthalin		*C. rotundus* L.	Rhizomes	48

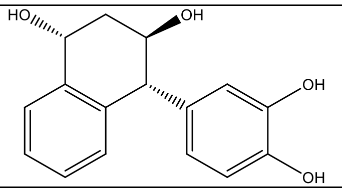
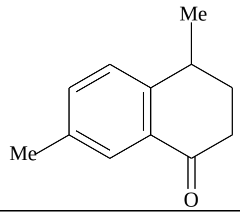
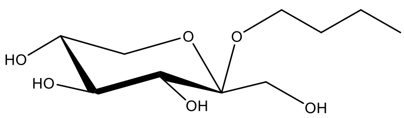
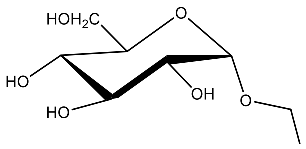
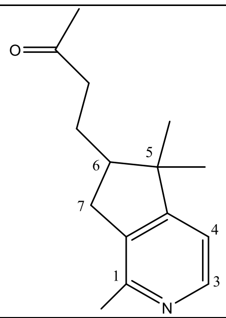
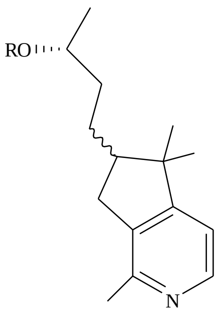
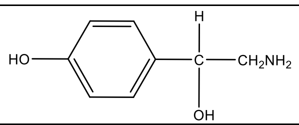
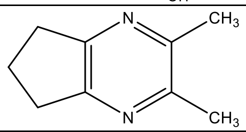
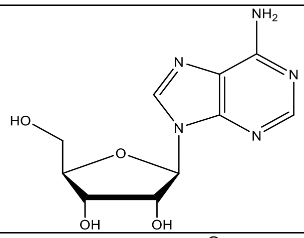
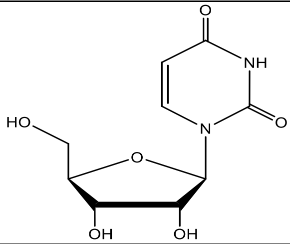
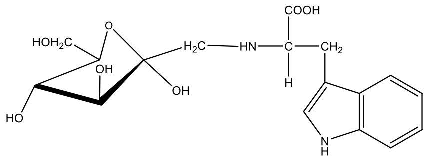
1α,3β-Dihydroxy-4α-(3′,4′-dihydroxyphenyl)-1,2,3,4-tetrahydronaphthalin		*C. rotundus* L.	Rhizomes	48
4,7-Dimethyl tetralone		*C. rotundus* L	tubers	49
n-Butyl-β-D-fructopyranoside		*C. rotundus* L.	Areal parts	12
Ethyl-α-D-glucopyranoside		*C. rotundus* L.	Areal parts	12

Table 2: Main nitrogenous constituents isolated from different *Cyperus* species.

Compound name	Structure	Plant source	Organ	Ref.
Rotundine A		*C. rotundus* L.	Rhizomes	50
Rotundine B R = H Rotundine C (6–epi–rotundine B)		*C. rotundus* L.	Rhizomes	50
Octopamine		*C. rotundus* L. *C. papyrus* L. *C. esculentus* L.	Rhizomes	51,52
6, 7-Dihydro-2, 3-dimethyl-5-cyclopentapyrazine		*C. rotundus* L. *C. papyrus* L. *C. esculentus* L.	Rhizomes	51,52

Adenosine		*C. rotundus* L.	Aerial parts	12
Uridine		*C. rotundus* L.	Aerial parts	12
Tryptophan α-D-fructofuranoside		*C. rotundus* L.	Aerial parts	12

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