Chapter 8

Phytochemical Diversity in Cyperaceae Members

Abstract

The phytochemistry of Cyperaceae members is generally restricted to the most common member, *Cyperus rotundus*, while there are 5687 species reported globally. A review of the phytochemistry of other Cyperaceae members revealed that only 180 species have been studied, and among the various Cyperaceae groups, *Cyperus* (97species), *Carex* (53 species) and *Scirpus* (19 species) are the major genera studied for their phytochemicals. Out of the 274 Cyperaceae members reported from south India, only 39 species have been investigated for their phytochemicals, and many of them are preliminary screening only. GC-MS studies on essential oils and LC-MS studies on solvent extracts are the most explored, while conventional phytochemical studies through extraction, chromatographic separation and spectroscopic characterization are comparatively less. In addition to volatile sesquiterpnoids, phenolic compounds are reported in plenty in the Cyperaceae species. Presence of characteristic compounds such as stilbenes and quinones warrants further studies on Cyperaceae members.

Introduction

Traditionally, the phytochemical investigation of Cyperaceae members is restricted to the most widely used *Cyperus rotundus* and few related *Cyperus* species like *Cyperus scariosus,Cyperus conglomeratus*, *Cyperus esculentus*, *Cyperus distans*, *Cyperus articulatus* and *Cyperus longus*, which are being used in traditional medicinal systems in different parts of the world. Though several other Cyperaceae members are important region wise, they are least investigated with respect to their constitution or potential biological activities, and though the phytochemistry of *Cyperus rotundus* has been reviewed extensively, compilation of the phytochemistry of Cyperaceae members is rare (Taheri *et al.*, 2021).

The conventional analytical techniques, as well as the modern hyphenated analytical techniques have been used for the investigation of Cyperaceae phytochemistry. Harborne and team in their classical works employed traditional phytochemical techniques skilfully in elaborating the flavonoid profile of Cyperaceae members (Clifford and Harborne, 1969; Harborne, 1971; Harborne *et al.*, 1985). Noori *et al.* (2012) investigated the root flavonoids of 5 *Scirpus* species using 2-dimentional paper chromatography and thin layer chromatography. By employing the recent developments in phytochemical analytical techniques, Elshamy *et al.* (2020) performed a comprehensive metabolite profiling of *Cyperus conglomeratus* using UPLC-qTOF-MS, and 70 compounds including organic acids, phenolic acids, cinnamic acid derivatives, flavonoids, stilbenes, aurones, quinones, terpenes and steroids were identified by comparing retention times and MS data, through accurate mass, isotopic distribution, and fragmentation pattern in both negative and positive ionization modes. Though widely distributed with remarkable traditional uses, the Indian Cyperaceae plants are generally least investigated (Rajak and Ghosh, 2022).

Phytochemistry of Cyperaceae members can be broadly divided into proximate composition reporting mainly the primary metabolites, volatile composition and non-volatile composition. Proximate analysis is used to estimate the relative amounts of protein, lipid, water, ash, carbohydrate *etc* in any sample, and is the first and foremost step to determine the identity and to assess the quality of plant material. Most of the Cyperaceae members are aromatic and the volatile chemicals have significance, while the characteristic phenolic, terpene and nitrogenous compounds are of non-volatile, and extractable with organic solvents.

Proximate analysis of Cyperaceae members

Geophytes, plants with underground storage organs, are important forage for animals, and the proximate analysis of the arial parts of geophytes has relevance with respect to the nutritional aspects of the forage plants (Al-Rowaily *et al.*, 2019; Mashaly *et al.*, 2007). Cyperaceae plants that grow naturally in sandy habitats with low content of water has high dry matter content, usually around 90%. The less moisture content (generally less than 10%) makes them more stable for storage. The ash content is around 10% for *Cyperus capitatus*, while the crude fiber content is around 12% for *Cyperus conglomeratus*. The total protein content is considered as an indicator of the nutritional value and is relatively high (>10%) for Cyperaceae tubers. The dry matter of forage crops contains about 50-80% carbohydrates, and the energy level for *Cyperus capitatus* was 311.62 kcal 100 g^{-1}.

Although fats are a concentrated source of energy, for Cyperaceae forage the fat content is significantly less, around 3%. However, few species such as *Cyperus esculentus* are reputed as rich in fatty acids. *Cyperus esculentus* tubers, commonly known as Chufa tubers contain high amount of dietary fiberthat consists of insoluble carbohydrates, mainly cellulose and lignin. Chufa is potentially a commercial source of higholeic acid vegetable oil and highcarbohydrate tuber cakes. The proximate analyses reveal fats (30.2%), starch (35.0%), protein (12.0%), ash 1.2 %), dietary fibre (9.8%) and sucrose 11.8% in *Cyperus esculentus* tubers (Coşkuner *et al.,* 2002). Mineral composition of forage has essential physiological roles in animals, in maintaining the livestock health, and Cyperaceae forage is reported to have both macro (K, Ca, Mg, and Na) and micro elements (Fe, Mn, Zn, and Cu), and have comparatively higher contents of Na, Fe and Mn.

Comparative nutritional analysis of *Cyperus rotundus* and *Cyperus esculentus*

The nutritional analysis of Cyperaceae members needs much attention since several Cyperaceae species are used as food from ancient times onwards. Studies revealed that, among the various Cyperaceae members, *Cyperus rotundus* and *Cyperus esculentus* were highly nutritional**.** Musa *et al*. (2020) had done a comparative proximate analysis of *Cyperus rotundus* and *Cyperus esculentus. Cyperus rotundus* had a higher moisture content than *Cyperus esculentus* which could mean that the *Cyperus esculentus* variety can be stored longer than the *Cyperus rotundus*variety. Total ash content is a rough indicator of the mineral content of a food sample. *Cyperus rotundus* had higher ash content than *Cyperus esculentus* suggesting higher mineral content than *Cyperus esculentus*. The presence of zinc, copper, cobalt, calcium and phosphorus in both species suggest that regular consumption could help mitigate the diseases resulting from these mineral deficiencies. *Cyperus rotundus* and *Cyperus esculentus* consist of some trace elements also. Ekeanyanwu and Ononogbu (2010) reported that the lipid found in *Cyperus rotundus* and *Cyperus esculentus* is edible. Carbohydrate is abundant in both the species. The free carbohydrates D-saccharose, D-glucose, D-mannitol and D-fructose were determined in *Cyperus esculents*. The total content of fructans was determined by the spectrophotometric method at13.5% and in tubers the fructans content was 8.8% (Marchyshyn *et al*., 2021). Adejuyitan (2011) also reported relatively low protein content for both *Cyperus rotundus* and *Cyperus esculentus*. The low protein content suggests that although both the species have rich energy content and high satiety values, they cannot be used as complete or whole diet because of the low protein content.

Phytochemicals reported from Cyperaceae members

Literature review on the phytochemicals reported from Cyperaceae members revealed that out of the 5687 Cyperaceae members, only 180 species have been investigated for the constituents (**Table 1).** Out of the 274 Cyperaceae members reported from south India, only 39 species have been investigated for their phytochemicals, and many of them are preliminary screening only. Only the major components of the essential oils are included in the table. In addition to *Cyperus* (97 species), the major genera investigated for the phytochemicals are *Carex* (53 species) and *Scirpus* (19 species). Out of the 274 Cyperaceae members reported from south India, only 39 species have been investigated for their phytochemicals, of which *Cyperus* is the major genus with 31 species, followed by *Carex* (3 species), *Kyllinga* (3 species), *Rhynchospora* (1 species) and *Scleria* (1 species). Volatile chemical studies through GC-MS and LC-MS studies of solvent extracts are the most explored, while the number of species investigated through conventional phytochemical steps such extraction, chromatographic separation and spectroscopic characterization are much less.

Table 1. Phytochemicals reported from Cyperaceae members

Sl. No.	*Cyperaceae* species	Phytochemicals reported	Reference
1.	*Carex acuta*	Linoleic acid, α-linolenic acid, oleic acid, palmitic acid	Bogucka-Kocka and Janyszek, 2010
2.	*Carex acutiformis*	Tricin 5-glucoside, iso orientin	Harborne, 1971
3.	*Carex albicans*	Apigenin 7-glucoside, luteolin 7-xyloside, luteolin 7-methyl ether 4'-diglucoside, chrysoeriol 7-glucoside, chrysoeriol 7-xyloside, chrysoeriol 7,4'-diglucoside, chrysoeriol 7,4'-dixyloside, luteolin 7-methyl ether, iso-orientin	Rettig and Giannasi, 1990
	Carex albicans var. *emmonsii*	Apigenin 7-glucoside, luteolin 7-xyloside, luteolin 7-methyl ether	Rettig and Giannasi, 1990

		4'-diglucoside, chrysoeriol 7-glucoside, chrysoeriol 7-xyloside, chrysoeriol 7,4'-diglucoside, chrysoeriol 7,4'-dixyloside, luteolin 5-glycoside, luteolin 7-methyl ether, iso-orientin	
	Carex albicans var. *australis*	Apigenin 7-glucoside, luteolin 7-xyloside, chrysoeriol 7-glucoside, chrysoeriol 7-xyloside, chrysoeriol 7,4'-diglucoside, chrysoeriol7,4'-dixyloside, luteolin 7-methyl ether, luteolin 5-substituted aglycone, luteolin 7-methyl ether, iso-orientin	Rettig and Giannasi, 1990
4.	*Carex alopecuroides*	Catechin, caffeic acid, ferulic acid, biochanin A	Rajak and Ghosh, 2022
5.	*Carex appropinquata*	Linoleic acid, α-linolenic acid, oleic acid, palmitic acid	
6.	*Carex appressa* var. *virgata*	Piceatannol, ε-viniferin, virgatanol	Arraki *et al.*, 2017
7.	*Carex arenaria*	Caffeic acid, p-coumaric acid, vanillic acid, synapic acid	Bogucka-Kocka *et al.*, 2011
	Carex arenaria (Leaves)	Tricin	Van de Staaij *et al.* 2002
8.	*Carex baccans*	trans-Resveratrol, α-viniferin, smiglasid A, B	Kumar *et al.*, 2013 Giri *et al.*, 2015
		Phloroglucinol, caffeic acid, ferulic acid	Rajak and Ghosh, 2022
9.	*Carex buchananii*	Kobophenol A	Arraki *et al.*, 2013
10.	*Carex capillacea*	Longusol B, (E)-miyabenol A	Arraki *et al.*, 2013
11.	*Carex contigua*	Linoleic acid, α-linolenic acid, oleic acid, palmitic acid, stearic acid	Bogucka-Kocka and Janyszek, 2010
12.	*Carex cruciata*	Caffeic acid, rosmarinic acid	Rajak and Ghosh, 2022
13.	*Carex cuprina*	Carexinol A, kobophenol A	Arraki *et al.*, 2017 Arraki *et al.*, 2013
14.	*Carex curta*	Caffeic acid, p-coumaric acid, vanillic acid, ferulic acid	Bogucka-Kocka *et al.*, 2011
15.	*Carex diandra*	Caffeic acid, p-coumaric acid, ferulic acid	Bogucka-Kocka *et al.*, 2011
		Linoleic acid, α-linolenic acid, oleic acid, palmitic acid	Bogucka-Kocka and Janyszek, 2010
16.	*Carex dimorpholepis*	trans-Resveratrol	Lee *et al.*, 2013 Buommino *et al.*,

			2017 Fiorentino *et al*., 2008 D'Abrosca *et al*., 2005 Fiorentino *et al*., 2006
17.	*Carex distachya*	Carexane A-P, pallidol	Fiorentino *et al*., 2008 Buommino *et al*., 2017 D'Abrosca *et al*., 2005 Fiorentino *et al*., 2006
		Caffeic acid, p-coumaric acid	Bogucka-Kocka *et al*., 2011
		Distachyasin	Fiorentino *et al*., 2006
	Carex distachya (Leaves)	Feruloyl monoglyceride macrocycles, dibenzoxazepinones	Fiorentino *et al*., 2007
		(+)-Pinoresinol 4-O-β-D-glucopyranoside, (+)-phylliroside, (+)-8-hydroxypinoresinol 4-Oβ-D-glucopyranoside, (+)-8-hydroxypinoresinol 8-O-β-D-glucopyranoside	Ricci *et al*., 2008
		5′-O-β-D-Glucopyranosyloxy-3,3′-dimethoxy-7,9′-epoxylignan-4,8′,9-triol, 3,5-bis-O-β-D-glucopyranosyloxy-3′-methoxy-trans-stilben-4′-ol, synapic alcohol 4-O-β-D-glucopyranoside, (+)-pinoresinol 4-O-β-D-glucopyranoside, phylliroside, (+)-1-hydroxy pinoresinol 4′-O-β-D-glucopyranoside, tanegosides A, 3-(4-O-β-D-glucopyranosyloxy-3,5-dimethoxy) phenyl-2E-propenol, phenylethanoid glycosides, decaffeoylverbascoside, isoverbascoside, verbascoside,	Fiorentino *et al*., 2008

		teucrioside, pallidoldiglucoside, 10-hydroxyligustroside, tricin, tricin 4’-O-(erythro-β-guaiacylglyceryl)ether, apigenin-6-C-β-D-xylopyranosyl-8-C-β-D-glucopyranoside, apigenin-6-C-β-D-glucopyranosyl-8-C-β-D-xylopyranoside, luteolin-6-β-D-glucopyranosyl-8-C-β-D-xylopyranoside	
		13-Hydroxy-clerodane-7,4-diene, 15-hydroxy-clerodane-7,13-diene	Fiorentino *et al.*, 2010
18.	*Carex divulsa*	Caffeic acid, p-coumaric acid, vanillic acid, ferulic acid	Bogucka-Kocka *et al.*, 2011
19.	*Carex elata*	Caffeic acid, p-coumaric acid, synapic acid	Bogucka-Kocka *et al.*, 2011
		Linoleic acid, α-linolenic acid, oleic acid, palmitic acid	Bogucka-Kocka and Janyszek, 2010
20.	*Carex fedia* var. *miyabei*	ε-Viniferin, trans-miyabenol C, (E)-miyabenol A, miyabenol B	Suzuki *et al.*, 1987
21.	*Carex flava*	Linoleic acid, oleic acid, palmitic acid, stearic acid	Bogucka-Kocka and Janyszek, 2010
22.	*Carex floridana*	Chrysoeriol 7-glucoside, chrysoeriol 7,4'-diglucoside, chrysoeriol 7,4'-dixyloside, tricin 7-xyloside, luteolin 5-glycoside, luteolin 7-methyl ether, iso-orientin	Rettig and Giannasi, 1990
23.	*Carex folliculata*	Pallidol, kobophenol A, iso-orientin, luteolin, quercetin, 3-O-methylquercetin, rutin	González-Sarrías *et al.*, 2011 Li *et al.*, 2009
24.	*Carex glauca*	Pallidol, α-viniferin, cis-miyabenol C	Arraki *et al.*, 2013 Fiorentino *et al.*, 2008
25.	*Carex gynandra*	Pallidol, α-viniferin, trans-miyabenol C, kobophenol B	González-Sarrías *et al.*, 2011
26.	*Carex hirta*	(E)-Miyabenol A	Arraki *et al.*, 2013
27.	*Carex humilis*	α-Viniferin	Lee *et al.*, 1998 Seo *et al.*, 2017
28.	*Carex insignis*	Phloroglucinol, quercetin, phloroglucinol	Rajak and Ghosh, 2022
29.	*Carex kobomugi*	ε-Viniferin, trans-miyabenol C, kobophenol A	Kawabata *et al.*, 1989 Kurihara *et al.*, 1991

30.	*Carex leporina*	Linoleic acid, α-linolenic acid, oleic acid, palmitic acid, stearic acid	Bogucka-Kocka and Janyszek, 2010
31.	*Carex montana*	Caffeic acid, p-coumaric acid	Bogucka-Kocka *et al*., 2011
32.	*Carex muricata*	Caffeic acid, p-coumaric acid, vanillic acid	Bogucka-Kocka *et al*., 2011
33.	*Carex nigra*	Caffeic acid, p-coumaric acid, vanillic acid, ferulic acid	Bogucka-Kocka *et al*., 2011
		Linoleic acid, α-linolenic acid, oleic acid, palmitic acid, stearic acid	Bogucka-Kocka and Janyszek, 2010
34.	*Carex nigromarginata*	Apigenin 7-glucoside, luteolin 7-xyloside, chrysoeriol 7-glucoside, chrysoeriol 7-xyloside, chrysoeriol 7,4'-diglucoside, chrysoeriol 7,4'-dixyloside, tricin 7-xyloside, luteolin 5-glycoside, iso orientin, luteolin C-glycoside	Rettig and Giannasi, 1990
35.	*Carex ornithopoda*	Caffeic acid, p-coumaric acid	Bogucka-Kocka *et al*., 2011
36.	*Carex otrubae*	Caffeic acid, p-coumaric acid, vanillic acid	Bogucka-Kocka *et al*., 2011
		Linoleic acid, α-linolenic acid, oleic acid, palmitic acid	Bogucka-Kocka and Janyszek, 2010
37.	*Carex ovalis*	Caffeic acid, p-coumaric acid, synapic acid, ferulic acid	Bogucka-Kocka *et al*., 2011
38.	*Carex panicea*	Caffeic acid, ferulic acid	Bogucka-Kocka *et al*., 2011
39.	*Carex paniculata*	Linoleic acid, α-linolenic acid, oleic acid, palmitic acid	Bogucka-Kocka and Janyszek, 2010
40.	*Carex peckii*	Luteolin 7-xyloside, chrysoeriol 7-glucoside, chrysoeriol 7-xyloside, luteolin 7-methyl ether, iso-orientin, luteolin C-glycoside	Rettig and Giannasi, 1990
41.	*Carex pendula*	cis-Miyabenol C, (E)-miyabenol A, kobophenol B	Meng *et al.*, 2001 Kurihara *et al.*, 1990 Kawabata *et al.*, 1991 Cho *et al.*, 2013
42.	*Carex praecox*	Vannilin, benzaldehyde, p-cresol, dehydrovomifoliol	David *et al*., 2021
43.	*Carex pseudocyperus*	Linoleic acid, oleic acid, palmitic acid	Bogucka-Kocka and Janyszek, 2010

44.	*Carex pumila*	Trans-Resveratrol, ε-viniferin, trans-miyabenol C, kobophenol B, (E)-miyabenol A	Kurihara *et al.*,1990 Cho *et al.*, 2013 Kawabata *et al.*, 1991
45.	*Carex remota*	Ferulic acid, rosmarinic acid	Rajak and Ghosh, 2022
		Caffeic acid, p-coumaric acid	Bogucka-Kocka *et al.*, 2011
46.	*Carex riparia*	Tricin 5-glucoside, iso-orientin	Harborne, 1971
47.	*Carex rostrata*	Caffeic acid, p-coumaric acid, vanillic acid	Bogucka-Kocka *et al.*, 2011
		Linoleic acid, oleic acid, palmitic acid	Bogucka-Kocka and Janyszek, 2010
48.	*Carex stramentitia*	Gallic acid, catechin, rosmarinic acid, quercetin	Rajak and Ghosh, 2022
49.	*Carex strigose*	Caffeic acid, p-coumaric acid	Bogucka-Kocka *et al.*, 2011
50.	*Carex sylvatica*	Caffeic acid, p-coumaric acid, vanillic acid, protocatechuic acid	Bogucka-Kocka *et al.*, 2011
51.	*Carex teres*	Gallic acid, phloroglucinol, quercetin	Rajak and Ghosh, 2022
52.	*Carex vulpina*	Caffeic acid, p-coumaric acid	Bogucka-Kocka *et al.*, 2011
		Linoleic acid, α-linolenic acid, oleic acid, palmitic acid, stearic acid	Bogucka-Kocka and Janyszek, 2010
53.	*Carex vulpinoidea*	Vulpinoideol A, vulpinoideol B, hopeaphenol, α-hydroxychalcone, grandiphenol A, 3,5,5′,7′-tetrahydroxyflavone, benzofuran, butein, luteolin, bavachalcone	Niesen *et al.*, 2011
54.	*Carpha glomerata*	Carphaben	Cho *et al.*, 2018
55.	*Cymophyllus fraseri* (Leaves)	Swertisin, iso-orientin, swertiajaponin, isovitexin, luteolin 7-O-glycoside, tricin 7-O-glucoside, apigenin 7-O-xylosylglucoside, luteolin 7-O-rutinoside, tricin 7-O-diglucoside, apigenin 7-O-glucoside, tricin 7-methyl ether 4'-O-glucoside, vicenin 1, vicenin 2, luteolin 7-O-diglucoside, luteolin 7,4'-O-diglucoside, 6-C-glycosyl apigenin, C-glycosyl luteolin,	Robert and James, 1988

		luteolin 7-methyl ether-O-glucoside	
	Cymophyllus fraseri (Flowers)	Luteolin 7-O-glucoside, apigenin 7-O-diglucoside, apigenin 7-O-glucoside, apigenin, luteolin, tricin, tricin 7-O-glucoside, iso-vitexin	Robert and James, 1988
56.	*Cyperus alopecuroides*	Caryophellene oxide, α-cyperone, 1,8-cineole, β-pinene, trans-pinocarveol, α-copaene, caryophyllene, α-humulene	El-Gohary, 2004
		α-Cubebene, trans-calamenene, δ-cadinene, iso-cyperol, trans-calamenene, β-caryophyllene, α-copaene, eudesma-2-4-11-triene, eudesma-3-11-dien-2-one, imperatorin	Sonwa and Konig, 2001
		2,4,11-Eudesmatriene, 3,5,11-eudesmatriene, cyperene, 2,4-patchouladiene, rotundene, cyprenal, cyprotene, cypera-2,4-diene, δ-cadinene, epoxy cyperene	Sonwa and Konig, 1997 Guenther, 1952 Hikino and Aota, 1976
		Luteolin 5-methyl ether, luteolin 7-glucoside, luteolin 7-diglucoside, tricin 5-glucoside, tricin 7-glucoside, sulphuretin, quercetin 3,4´-dimethyl ether	El- Habashi *et al*., 1989
		Luteolin 4´-methyl ether, vicenin 2, quercetin 3,3’-dimethyl ether, rengasin, kaempferol 3-O-β-D-(glucosylrutinoside), kaempferol 3-O-β-D-(xylosylrutinoside)	Sayed *et al*., 2006
		Orientin	Singh *et al*., 1986
		Imperatorin, bergapten, xanthotoxin, xanthotoxol, iso-scopoletin, esculetin	Awaad, 1999
		Dihydro cyperaquinone	Allan *et al*., 1978
		Aesculetin, bergapten	Awaad *et al*., 2001
		Alopecuquinone, diosmetin, dolabella-3-7-18-triene, orientin, patchoula-2-4-diene, quercetin 3,3'-dimethyl ether, diosmetin	Nassar *et al*., 2002
		Quercetin-3-rutinoside	El-Habashy *et al*.,1989

		α-Cyperone, cyperol	El-Gohary, 2004
		Dolabella-3,7,18-triene, α-pinene, β-selinene, benzaldehyde, p-cymene, limonene, 1,8-cineole, p-cymenene, α-terpineol, myrtenal, myrtenol, trans-carveol, isocitronellol, carvone, trans-caryophyllene, patchoulane	Sonwa *et al.*, 2001
57.	*Cyperus alternifolius*	Esculetin, umbelliferon, imperatorin, xanthotoxin, psoralen, quercetin, quercetin-3-O-rutinoside, gallic acid	Amani *et al.*, 2018
		6-Octadecenoic acid, 1-dodecanol, hexadecanoic acid, octadecanoic acid, 2,3-dihydroxypropyl ester, 9,12-octadecadienoic acid, 2,6-dihexadecanoate, 2-methyl-Z-4-tetradecene, hexadecyl neopentyl ester, 2-pentadecanone, campesterol, stigmasterol, γ-sitosterol, phytol, squalene, 6,10,14- trimethyl, 9,19-cyclolanost-24-en-3-ol, (3β)-2H-1-benzopyran-6-ol, 3,4-dihydro-2,8-dimethyl-2-(4,8,12-trimethyltridecyl), [2R-[2,α-tocopherol-β-D-mannoside,(Z)-,4,8,12,16-tetramethylheptadecan4-olide, 2-hydroxy-1-(hydroxymethyl)ethyl ester, (+)-ascorbic acid, sucrose	Taiba *et al.*, 2022
		Dimethyl cyperaquinone, dihydro cyperaquinone, tetrahydro cyperaquinone	Allan *et al.*, 1978
		Luteolin 5-methyl ether	Harbone *et al.*, 1982
		Luteolin 7-glucuronide	El-Habashy *et al.*, 1989
		Caryophyllene, caryophyllene oxide, farnesyl acetone	Elshrif *et al.*, 2017
	Cyperus alternifolius (Aerial part)	D-limonene, γ-terpinene, theaspirane A-B	Elshrif *et al.*, 2017
	Cyperus alternifolius	α-Cyperone, β-selinene, caryophyllene oxide, cyperene	Ahmed, 2012

	(Flower)		
58.	*Cyperus aquatilis*	Quercetin, luteolin 5-methyl ether	Harborne *et al.*, 1982
59.	*Cyperus arenarius*	Cyperene, cyperotundone	Feizbakhsh *et al.*, 2012
60.	*Cyperus aristatus*	Cyperaquinone, dimethyl cyperaquinone	Allan *et al.*,1978
61.	*Cyperus articulatus*	Corymbolol, α-corymbolone, mandassidione, patchoul-4(5)-en-3-one	Nyasse *et al.*, 1988
		Myrtenol, myrtenal, trans-pinocarveol	Bakaly, 2001
		Cyperotundone, 1,2-dehydro-α-cyperone,sesquichamaenol,mustakone	Brillatz *et al.*, 2020
		Myrtenal, myrtenol, copaene, articulone	Couchman *et al.*, 1964
		Mandassidione, mustakone, isopatchoul-4(5) en-3-one	Nyasse, 1988
		α-Campholenal, α-corymbolol, α-cyperone, α-pinene, cyperol, cyclocolorenone, β-copaen-4-α-ol, p-cymene, caryophyllene oxide, corybolane, mustakone, cyperotundone, limonene, thuja-2,4(10)-diene, trans-pinocarveol, p-mentha-1,5-dien-8-ol, myrtenal, mustakone	Dikwa *et al.*, 2019 Silva *et al.*, 2019
		α-Thujene, α-pinene, camphene, sabinene, β-pinene, p-cymene, limonene, m-cymene, eucalyptol	Heba *et al.*, 2014
		Luteolin 5-methyl ether	Harborne *et al.*, 1982
		Luteolin 7-glucoside, luteolin 7-rutinoside	El-Habashy *et al.*, 1989
		Copa-3-en-2α-ol, caryophyllene oxide, humulene epoxide-II, mustakone, kobusone, cyperotundone, humulene dioxide, (-)-guaia-1(10),11-dien-9-one, muurolane-2β,9β-diol-3-ene, corymbolone, p-hydroxybenzoic acid, trans-p-hydroxycinnamic acid, 2*R*/2*S* dihydroluteolin, 4R/4S-4-	Mittas *et al.*, 2022

		hydroxy-1,10-seco-muurol-5-ene-1,10-dione, trans-sobrerol, piceatannol, trans-scirpusin B, cyperusphenol B	
		Pinene, eucalyptol, myrtenol, copaene, cyperene, caryophyllene, patchoulene, caryophyllene oxide	Heba *et al*., 2014
		α-Campholenal, α-corymbolol, α-cyperone, α-pinene, cyperol, cyclocolorenone, β-copaen-4-α-ol, p-cymene, caryophyllene oxide, corybolane, cyperotundone, limonene, thuja-2,4(10)-diene, trans-pinocarveol, p-mentha-1,5-dien-8-ol, myrtenal, mustakone	Silva *et al*., 2019
	Cyperus articulates var. *articulates*	Mustakone, caryophyllene oxide	Zoghbi *et al*., 2006
	Cyperus articulates var. *nodosus*	Mustakone, caryophyllene oxide	Zoghbi *et al*., 2006
	Cyperus articulates Red type	Cyperotundone, piperitone, β-maaliene, germacrone	Nureni *et al*., 2006
	Cyperus articulates Black type	Cedrol, guaia-5-en-11-ol, cyperotundone	Nureni *et al*., 2006
62.	*Cyperus asiatica*	Asiatic acid	
63.	*Cyperus baoulensis*	Cyperotundone	Hikino *et al*., 1976
64.	*Cyperus bowmanii*	Apigenin, tricin, luteolin	Harborne *et al*.,1982
65.	*Cyperus brevibracteatus*	Breverin, breviquinone, hydroxy breviquinone	Allan *et al*.,1973
66.	*Cyperus brevifolius*	Quercetin, tricin	Harborne *et al*., 1982
		α-Cyperone, β-selinene, α-humulene	Komai *et al*., 1989
67.	*Cyperus bulbosus*	δ-Cadinene, calamenene, β-caryophyllene, α-copaene, cyperene, α-cyperone, β-elemene, cyperotundone, humulene oxide, α-humulene, luteolin, apigenin, patchoulenol acetate, β-selinene, sugeonol acetate	Harborne *et al*., 1982
		Luteolin 7-glucuronide, luteolin 7-diglucoside, tricin 7-diglucoside	El-Habashy *et al*., 1989
		Caryophyllene oxide, humulene oxide	Komai *et al*., 1994

68.	*Cyperus capitatus*	Aureusidin	Seabra *et al*., 1995
		4,6,3′,4′-Tetrahydroxy-5-methylaurone, 4,6,3′,4′-tetrahydroxy-7-methylaurone, 6,3′,4′-trihydroxy-4-methoxy-5-methylaurone, 6,3`-dihydroxy-4,4`-dimethoxy-5-methylaurone	Seabra *et al*., 1998
		Capiquinone A-K	Alves *et al*., 1992
		Flavan,3'-5-dihydroxy-4'-6-dimethoxy	Mogib *et al*., 2001
		Oleanolic acid, β-sitosterol, tocopherol	
		Cyprene, cyperotundone	El Gendy *et al*., 2017
		Sulphuretin	El-Habashy *et al*., 1989
		3,5, 3´,4´-Tetramethoxy stilbene	Abdel-Razik *et al*., 2005
69.	*Cyperus castaneus*	Apigenin	Harborne *et al*., 1982
70.	*Cyperus clarke*	Quercetin 3-methyl ether, kaempferol 3-methyl ether	Harborne *et al*., 1982
71.	*Cyperus compressus*	Apigenin, luteolin, luteolin-5-methyl ether, tricin	Harborne *et al*., 1982
		Cyperaquinone	Allan *et al*., 1978
		Vannilic acid, ferulic acid, rutin, myricetin, quercetin, apigenin	Datta *et al*., 2018
		Luteolin 7-glucuronide	El-Habashy *et al*., 1989
72.	*Cyperus congestus*	Aureusidin, cyanidin, luteolin, tricin	Harborne *et al*.,1985
73.	*Cyperus conglomerates*	Luteolin, luteolin 7-methyl ether, luteolin 7-glucuronide, 7,3'-dihydroxy-5,5'-dimethoxy-8-prenylflavan, 5,7,3'-trihydroxy-5'-methoxy-8-prenylflavan, 5-hydroxy-7,3',5'-trimethoxyflavan, 5,7-dihydroxy-3',5'-dimethoxy-6-prenylflavan, 2-prenyl-3,4'-dihydroxy-5-methoxystilbene, 5,7,4'-trimethoxy-6-prenylflavanan, 4-hydroxyallylbenzene, 3-ethoxy-4-hydroxyallylbenzene	Abdel-Razik *et al*., 2005 Nassar *et al*., 2005 Basaif, 2003 Abdel-Mogib *et al*., 2001 Nassar *et al*., 1998 El-Habashy *et al*., 1989
		Eugenol, α-cyperone,	Hisham *et al*., 2012

		cyperotundone	
		7,3′-Dihydroxy-8,4′-dimethoxy flavan, 7,4′-dihydroxy-5,3′-dimethoxy-8-methyl flavan, 7,4′-dihydroxy-5,3′-dimethoxy-8-prenyl flavan, 4-hydroxy-5′-methoxy-6″,6″-dimethylpyran [2″,3″: 3′, 2′] stilbene, 4′-hydroxy-3,5-dimethoxy-2-prenyl stilbene, 5,4′-dihydroxy-7,3′-dimethoxy flavan, 3′,4′-dimethoxy luteolin, 3′,4-dihydroxy-5′-methoxy-2′-prenyl stilbene, 4,4′-dihydroxy-3,3′-dimethoxy-2′-prenyl stilbene	Ahmed *et al*., 2018
		Palmitic acid, oleic acid, heptadecanoic acid, linoleic acid, arachidonic acid, lignoceric acid, stearic acid, myristic acid, α-amyrin, β-sitosterol	Ghaferah *et al*., 2018
		Quinic acid, malic acid, tetrahydroxypentanoic acid, citric acid, isocitric acid, malic acid, fumaric acid, leucine-hexose, homocitric acid, dihydroxybenzoic acid, dihydroxybenzoic acid methyl ester, dihydroxy benzoic acid-O-hexoside, hexahydroxyflavan, dihydroxy benzoic acid methyl ester hexoside, O-hexosyl-O-methyl-myo-inositol-dihydroxy benzoic acid, salicylic acid, p-hydroxybenzoyl tartaric acid, benzoyl tartaric acid, procyanidin B dimer, hexahydroxyflavan, C-hexosylprocyanidin B dimer, epi-catechin, caffeic acid, hydroxymethoxy cinnamaldehyde, O-caffeoylquinic acid, O-syringoylquinic acid, caffeoquinone, procyanidin B dimer, syringoylmalic acid, syringic acid, dihydroxyhomophthalic acid	Elshamy *et al*., 2020

		dimethyl ester, hydroxycinnamic acid, epi-catechin, eriodictyol, scopoletin, hydroxydimethoxy cinnamic acid, erulic acid, dihydrocyperaquinone, caffeoquinone isomer, trihydroxycoumestan, trihydroxyflavanone, tetrahydroxyflavanone, longusol C, hydroxymethoxycoumarin, trihydroxycinnamic acid dimethyl ether, luteolin, dimethoxy luteolin, hesperitin, tetrahydroxyflavanone, tetrahydroxymethyl aurone, trihydroxyflavanone, hydroxymethoxycinnamaldehyde, trihydroxyoctadecadienoic acid, trihydroxymethoxy methyl aurone, trihydroxyoctadecenoic acid, tetrahydroxymethyl aurone isomer, trihydroxymethoxyprenyl isoflavone, tetrahydroxyflavanone methyl ether, trihydroxy-prenylflavan, trihydroxymethoxyprenylflavan	
		β-Elemene, flavan,3'-5'-dihydroxy-6-7-dimethoxy-4'-prenyl	Mogib *et al*., 2000
		4'-5-7-Trimethoxy-6-prenyl flavanan	Nassar *et al*., 1998
		Luteolin 5-methyl ether, luteolin 7-glucuronide, tricin 7-glucuronide	El-Habashy *et al*., 1989
		7,3'-Dihydroxy-5,5'-dimethoxy-8-prenylflavan, 5,7,3'-trihydroxy-5'-methoxy-8-prenylflavan	Razik *et al*., 2005
		α-Amyrin, β-sitosterol, palmitic acid, oleic acid, heptadecanoic acid, linoleic acid, arachidonic acid, lignoceric acid, stearic acid, myristic acid	Al-Hazmi *et al*., 2018
		5-Hydroxy-7,3',5'-trimethoxyflavan,7-dihydroxy-3',5'-dimethoxy-6-prenylflavan	Mogib *et al*., 2000

74.	*Cyperus conicus*	Conicaquinone, hydroxy cyperaquinone	Allan *et al*., 1978
75.	*Cyperus corymbosus*	Corymbolone, iso-corymbolone, α-cyperone	Garbarino *et al*., 1985
76.	*Cyperus cunninghamii*	Jaranol, isokaempferide, quercetin 3-methyl ether, kaempferol 3-methyl ether, kaempferol 3,7-dimethylether	Harborne *et al*., 1982
77.	*Cyperus cuspidatus*	Apigenin, luteolin	Harbone *et al*., 1982
78.	*Cyperus cyperoides*	Hydroxy cyperaquinone	Allen *et al*., 1978
79.	*Cyperus cyperinus*	Luteolin 5-methyl ether	Harbone *et al*., 1982
80.	*Cyperus dactylotes*	Quercetin 3-methyl ether, quercetin 3,7-dimethyl ether	Allen *et al*., 1978
		Kaempferol 3-methyl ether, kaempferol 3,7-dimethylether	Harborne *et al*., 1982
81.	*Cyperus decompositus*	Cyperaquinone, hydroxy cyperaquinone	Allen *et al*., 1978
82.	*Cyperus dietricheae* var. *brevibracteatus*	Breviquinone, hydroxy breviquinone	Allen *et al*., 1978
83.	*Cyperus difformis*	α-Cadinol, β-caryophyllene, cyperotundone, α-humulene	Iwamura *et al*., 1979
		Cyperene, cyperotundone, isorotundene	Feizbakhsh *et al*., 2012.
		3,7,11,15 Tetramethyl-2-hexadecen-1-ol, phytol, 2-furancarboxaldehyde,5-(hydroxymethyl), acetic acid, 2-(2,2,6-trimethyl-7- oxa-bicyclo[4.1.0]hept-1-yl)- propenyl ester, α-tocopherol-β-D-mannoside, phenol, 2,3,5,6-tetramethyl-)- 7, cholestan-3-one, 4,4-dimethyl-(5α)-, γ-sitosterol, ascorbic acid 2,6-dihexadecanoate, butyl 9,12,15-octadecatrienoate, hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester, octadecanoic acid, 2,3-dihydroxypropyl ester, 9,12-octadecadienoic acid (Z,Z)-, butanamide, N-(4-methoxyphenyl)-, hydrazinecarboxamide, 2-(2-	Taiba *et al*., 2022

		methylcyclohexylidene, dichloroacetic acid, tridec-2-ynyl ester, 3-acetoxy-3-hydroxypropionic acid, methyl ester, norvaline, n-methoxycarbonylbutyl ester	
		Luteolin 7-glucuronide, luteolin 7-diglucoside, tricin 5-glucoside	El-Habashy *et al.*, 1989
		Cyprene, cyperotundone	El Gendy *et al.*, 2017
84.	*Cyperus digitatus*	Luteolin 7-glucuronide, tricin 5-glucoside, tricin 7-diglucoside	El-Habashy *et al.*, 1989
85.	*Cyperus disjunctus*	Luteolin 5-methyl ether	Harbone *et al.*, 1982
86.	*Cyperus distans*	Cyperene, α-pinene, 1,8-cineole, caryophyllene oxide	Oladipupo and Adebola, 2009
		α-Cyperone, cyperotundone, scabequinone	Vilhena *et al.*, 2014
		Zierone, caryophyllene oxide, α-cyperone	Lawal *et al.*, 2016
		Scabequinol, dihydro scabequinone	Allan *et al.*, 1973
		Cyperene, α-pinene, 1,8-cineole, caryophyllene oxide	Lawal and Oyedeji, 2009
		Zierone, caryophyllene oxide, α-cyperone	Oladipupo *et al.*, 2009
		Scabequinone	Morimoto *et al.*, 1999
87.	*Cyperus dubius*	1,4,8-Cycloundecatriene, 2,6,6,9-tetramethyl-, (E,E,E), 6-(1-hydroxy-1-methylethyl)-3-methyl-2-cyclohexen-1-yl acetate, guanosine, 1,3,4,5-tetrahydroxy-cyclohexanecarboxylic acid,1-octadecyne, hexahydrofarnesyl acetone, naphthalene, 1,2,3,5,6,7,8,8α-octahydro-1,8α-dimethyl-7-(1-methylethenyl)-, [1R- (1-α,7-β,8-α, 9-eicosyne, 5,9,13-pentadecatrien-2-one, 6,10,14-trimethyl-, (E,E)-, hexadecanoic acid, methyl ester, phenanthrene, 7-ethenyl-1,2,3,4,4a,4b,5,6,7,9,10,10a-dodecahydro-1,1,4a,7-	Srinivasan and Priya, 2015

		tetramethyl-, [4as-(4a.alpha.,4b.beta.,7.beta.,10a.beta, 9-octadecenoic acid (Z)-, cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-, [1s-(1.alpha.,2.beta.,4.beta.)]-, 2-methyl-2-[2-(2,6,6-trimethyl-3-methylene-cyclohex-1-enyl)-vinyl]-[1,3]dioxolane, 2-hexadecen-1-ol, 3,7,11,15-tetramethyl-, 9,12-octadecadienoic acid (Z,Z)-, *cis*-vaccenic acid, pentadecanal, 2,5-dimethoxybenzylamine, squalene, olivetol, dimethyl ether, γ-tocopherol, 9,19-cycloergost-24(28)-en-3-ol, 4,14-dimethyl-, acetate, (3-β,4-α,5- α)- 2h-1-benzopyran-6-ol, 3,4-dihydro-2,5,7,8-tetramethyl-2-(4,8,12-trimethyltridecyl)-, acetate, [2R-[2R*(4R*,8R*)]]-, 4-formyl-2-methoxyphenyl acetate, ergost-5-en-3-ol, (3β)-, stigmasterol, stigmast-5-en-3-ol, 2-methylpyrazine, 2,6-dimethylpyrazine, 2-ethylpyrazine, 2,3-dimethylpyrazine, 2-ethyl-6-methylpyrazine, 2-ethyl-5-methylpyrazine, 2,3,5-trimethylpyrazine, 2-ethyl-3,5-dimethylpyrazine, tetramethylpyrazine, 2-ethyl-3,5,6-trimethylpyrazine, 2-pentylpyridine, quinoline, 2-acetyl-pyrrole, guaipyridine, guai-9,11-dienpyridine, epi-guaipyridine, methyl anthranilate, 2-phenylpyridine, cananodine	
88.	*Cyperus enervis*	Apigenin	Harborne *et al*., 1982
89.	*Cyperus eleusinoides*	Scabiquinone	Allan *et al*., 1978
90.	*Cyperus eragrostis*	Scirpusin B, cyperusphenol B	Arraki *et al*., 2017
		Cyperaquinone, hydroxy cyperaquinone	Allen *et al*., 1978

91.	*Cyperus esculentus*	α-Thujene, α-pinene, camphene, sabinene, β-pinene, myrcene, o-cymene, p-cymene, limonene, m-cymene, eucalyptol	Heba *et al*., 2014
		β-Pinene, cymene, cyperene, coumaran, cyperotundone, p-vinylguaiacol, vanillin, cyprotundone	Gugsa and Yaya, 2018
		Luteolin 7-glucuronide	El-Habashy *et al*., 1989
		Luteolin 7-glucoside, luteolin 7-diglucoside	El-Habashy *et al*., 1989
		2-O-Galloyl-1,4-galactarolactone, scopoletin, imbricantonol, p-hydroxybenzoic acid, L-leucic acid, vanillic acid, ethyl vanillin, 4-vinylphenol, ferulic acid, p-coumaric acid, 3-hydroxyphloretin 20-O-glucoside, kaempferol 3,7-diglucoside, sophoraflavonoloside, luteolin-7,30-di-O-glucoside, dehydrodivanillin, veronicafolin 3-glucosyl-(1-3)-galactoside, sinensetin, sinapyl alcohol, p-coumaric acid ethyl ester, cyanidin, benzoic acid, dihydroxy stearic acid, hydroxy palmitic acid, hydroxy stearic acid, linolenic acid, myristic acid, palmitoleic acid, linoleic acid, methylpalmitic acid, palmitic acid, oleic acid, heptadecanoic acid, stearic acid	Diaz *et al*., 2022
		4-Hydroxybenzaldehyde, p-coumaric acid, ferulic acid, sinapinic acid, cinnamic acid, luteoline, naringenin	Pelegrin *et al*., 2022
		trans-13-Octadecenoic acid, hexadecanoic acid ethyl ester, octadecanoic acid, (E)5-octadecene, 9-octadecenoic acid, behenic alcohol, γ-sitosterol, stigmasterol, campesterol, lanosterol, squalene, vitamin E, benzenepropanoic acid, 2,4-di-	Olukanni *et al*., 2022

		tert-butylphenol, 4-cyclohexylamino 3H-[1,2,3] triazole, 3-cyclohexyl-5-(1H-pyrazol-3-yl) 2,4-dimethyl benzo[H] quinoline, 4-phenyl pyrido[2,3-D] pyrimidine, β-tocopherol, 3,5-bis(1,1-dimethylethyl)-4-hydroxy octadecyl ester 1H-1,3-benzimidazole, 5,6-dimethyl-1-[(2,3,5,6-tetramethylphenyl)methyl]1-methoxy-3-(2-hydroxyethyl) nonane, 9,10-methanoanthracen-11-ol, 9,10-dihydro-9,10,11-trimethyl diltiazem, 5-methyl-2-phenyl 1H-indole	
		Quercetin, stigmasterol, linoleic acid, oleic acid, 4-chlorobutyl oleate, oleamide, myricetin, tyramine, n-feruloyltyramine	Vega-Morales *et al.*, 2019
		Oleic acid, palmitic acid, linoleic acid	Coşkuner *et al.*, 2002
		2-Oxo-4-hydroxy-4 carboxy-5-ureidoimidazoline, amylose, arginine, ascorbyl glucoside, citric acid, fumaric acid, galactinol dihydrate, gluconic acid, kojic acid, leucine, L-ornithine, malic acid, quinic acid, sucrose, trehalose/maltose, trisaccharide (raffinose), uridine, xylo-manno-nononic acid ɣ-lactone	Saeed *et al.*, 2022
92.	*Cyperus exaltatus*	Cyperaquinone	Morimoto *et al.*, 1999
93.	*Cyperus fenzelianus*	Luteolin 5-methyl ether, luteolin 7-glucuronide, tricin 5-glucoside, tricin 7-diglucoside	El-Habashy *et al.*, 1989
94.	*Cyperus fissus*	Luteolin 5-methyl ether	Harborne *et al.*, 1982
95.	*Cyperus flaccidus*	Luteolin 5-methyl ether, quercetin	Harborne *et al.*, 1982
96.	*Cyperus flavescens*	Luteolin 5-methyl ether	Harborne *et al.*, 1982
97.	*Cyperus fuscus*	Luteolin 7-glucuronide,	El-Habashy *et al.*,

		sulphuretin	1989
		Dehydroaromadendrene, azulenone, α-selinene, α-ylangene, β-caryophyllene	Erdem *et al*., 2018
98.	*Cyperus gigantens*	Cyperotundone, cyperene	Zoghbi *et al*., 2006
99.	*Cyperus globosus*	α-Cadinol	Bordoloi, 1998
100.	*Cyperus glomeratus*	Thunbergin A-B, trans-resveratrol, trans-scirpusin A, trans-cyperusphenol A, aureusidin, luteolin	Arakki *et al*., 2021
		Caryophyllene oxide, humulene epoxide II, β-caryophyllene, α-humulene	Lazarević *et al*., 2010
101.	*Cyperus haspan*	Cyperaquinone, dihydro cyperaquinone, quercetin	Allan *et al*., 1978
		Mangiferin, isomangiferin	Harborne *et al*., 1982
102.	*Cyperus imbricatus*	Luteolin 7-glucuronide	El-Habashy *et al*., 1989
103.	*Cyperus incompletus*	Umbelliferone, scopoletin, 5,7-dimethoxycoumarin, 7,8-dimethoxycoumarin, 5,7,8-trimethoxycoumarin, leptodactylone, prenyletin, 5,7-dimethoxy-8 (γ,γ-dimethylallyloxy) coumarin, 7-methoxy-8- (γ,γ-dimethylallyloxy) coumarin, 7-(γ,γ-dimethylallyloxy) 8-methoxycoumarin	Dini *et al*., 1993
104.	*Cyperus iria*	Aureusidin	Harborne *et al*., 1982
		δ-Cadinene, γ-cadinene, α-cadinol, calamene,caryophyllene, α-copaene, p-cymene, cyperene, dodeca-cis-3-cis-5-dien-1-ol, dodeca-cis-3-cis-5-dienol acetate, limonene, linalool,mariscetin, α-pinene, β-pinene	Iwamura *et al*.,1978
		Cyanidin	Harborne *et al*., 1985
		Myercetin, quercetin, kaempferol, ferulic acid	Myeda Saeed *et al*., 2022
		Methyl (2E, 6E)-farnesoate	Fraga, 1992
		Limonene, β-ocimene, linalool, α-	Jiang *et al*., 2013

		gurjunene, germacrene D, β-elemene, E-β-caryophyllene, α-humulene, α-bergamotene, α-farnesene, elemol, hedycaryol, γ-eudesmol, β-eudesmol, α-eudesmol	
105.	*Cyperus ischnos*	γ-Muurolene	Bordoloi, 1998
106.	*Cyperus javanicus*	2-Hydroxy-5-methoxy-3-heptadec-8-enyl 1-4 benzoquinone, cyperaquinone, hydroxy cyperaquinone	Morimoto *et al*.,1999
107.	*Cyperus kyllinga*	α-Copaene, β-bourbonene, β-elemene, β-caryophyllene, spathulenol, caryophyllene oxide	Vian *et al*.,2008
		α-Humulene, γ-muurolene, germacrene D, β-selinene, α-valencene, δ-cadinene, α-cubebene	Fraternale *et al*., 2007
		γ-Cadinene, palmitic acid, α-muurolene	Bendimerad *et al*., 2005
		(Z)-Calamenene, δ-amorphene, *t*-muurolol, α-muurolol, α-cadinol, α-atlantone, farnesol	Boyom *et al*., 2003
		α-Cyperone, β-selinene, α-humulene	Komai *et al*., 1989
108.	*Cyperus kyllingiella*	Alanine, phenyl alanine, arginine, aspartic acid, glutamic acid, glycine,histidine, leucine, iso-leucine	Yeoh *et al*., 1986
109.	*Cyperus laevigatus*	Octadec-1-ene, palmitic acid, stigmasterol, luteolin 5-methyl ether, apigenin	Nassar *et al*., 2000
		Luteolin 5-methyl ether	Harborne *et al*., 1982
		Luteolin 7-glucuronide	Harborne *et al*., 1982
		Luteolin 7-glucuronide-4`-glucoside, apigenin 7-glucoside, apigenin 7-glucuronide, tricin 5-diglucoside, tricin 7-glucuronide, tricin 7,4`-diglucoside, tricin 7-diglucoside	El-Habashy *et al*., 1989
		Hexahydrofarnesyl acetone, Z-myroxide, phytol, limonene, E-myroxide, cis-carveol	Nassar *et al*., 2015.

		Hydroxy dodecenedioic acid, dihydroxy decenoic acid, hydroxy octadecenedioic acid, hydroxy octadecadienoic acid, hydroxy tetradecanoic acid, hydroxy docosanoic acid, hydroxy tetracosenoic acid, hydroxy pentadecanoic acid, hydroxy hexadecenoic acid, hydroxy eicosanoic acid, arachidic acid, hexacosanoic acid, hydroxy tetracosanoic acid, octadecanoic acid, octadecatrienoic acid, trihydroxy octadecenoic acid, hydroxy palmitic acid, hexadecenoic acid, docosanedioic acid, pentacosanedioic acid, eicosanedioic acid, gluconic acid, tetrahydroxy pentanoic acid, hexose, malic acid, fumaric acid, quinic acid, citric acid, isocitric acid, O-caffeoylquinic acid, O-coumaroylhexose, asperuloside, hydroxybenzoic acid, feruloyl quinic acid, feruloyl quinic acid, feruloyl-O-hexoside, caffeic acid, 9 O-syringoylquinic acid, coumaroyl quinic acid, leptosidin-O-dipentoside, luteolin di-O-hexoside, luteolin, isorhamnetin, luteolin-O-hexoside-O-glucuronide, O-syringoylquinic acid O-(hydroxydimethoxybenzoyl)-quinic acid, dicaffeoylquinic acid, O-coumaroylglycerol, O-caffeoyl-O-syringoylquinic acid, tetrahydroxydimethoxyflavone di-O-hexoside, hydroxycinnamic acid, dihydroxy-dimethoxymethylaurone, tetrahydroxy dimethoxy flavonedi-O-hexoside, luteolin-O-deoxyhexoside-O-glucuronide, hydroxyoctanoic acid-O-hexoside, hydroxycinnamoyl-O-	Iriny *et al*., 2022

		malic acid, tetrahydroxyflavone-O-pentosylhexoside, tetrahydroxyaurone-O-glucuronide, aureusidin, tetrahydroxymethoxyflavone O-glucuronide, pentahydroxymethoxyflavone O-glucuronide, ferulic acid, tetrahydroxy methoxyflavone O-glucuronide, luteolin-O-glucuronide, tetrahydroxy methylaurone, luteolin-5-methyl ether, luteolin methyl ether glucuronide, tricin, luteolin-O-deoxyhexoside, trihydroxy flavone-O-glucuronide, tricin-7-O-deoxyhexosyl O-hexoside, tricin-7-O-hexosyl sulfate, tetrahydroxy methoxyflavone-O-sulfate, tricin-7-O-glucuronide, tetrahydroxy aurone-O-hexoside, luteolin-O-hexoside, dihydroxy methoxyaurone, dihydroxy methoxyflavone, tricetin	
110.	*Cyperus laevis*	Quercetin	Harborne *et al.*, 1982
111.	*Cyperus laxus* (Leaves)	Palmitic acid, octadecanoic acid, oleic acid, eichosanoic acid	Casado *et al.*, 2015
112.	*Cyperus longus*	Brevicarine, brevicolline	Nassar *et al.*, 2000
		Cassigarole, catechin, epi-catechin, longusol A-C	Morikawa *et al.*, 2002
		Cyperusol A1, A2, B1, B2, D	Fengming, 2004
		Cyperusol C	Ohira *et al.*, 1998
		Longusol A-C, cassigarol E, cassigarol G, pallidol, longusone A, resveratrol, piceatannol, trans-scirpusin A-B	Morikawa *et al.*, 2010
		α-Caryophyllene oxide, β-himachalene, β-caryophyllene oxide, aristolone, humulene oxide, irisone, longiverbenone, viridiflorol, caryolan-1,9-betadiol, clovanediol, tricyclohumuladiol, p-menth-1-en-7,8-diol, sobrarol,7,15-epoxycaryophyllane-3,5-betadiol	Memariani *et al.*, 2016

	Cyperus longus (Leaves)	Tricin, luteolin 7-arabinosylglucoside	Harborne, 1971
113.	*Cyperus lucidus*	Luteolin 5-methyl ether	Harborne *et al.*, 1982
114.	*Cyperus maculatus*	Mustakone	Nyasse, 1988
		Luteolin 5-methyl ether, luteolin 7-glucuronide, luteolin 7-glucoside, luteolin 7-diglucoside, tricin 5-glucoside	Harbone *et al.*, 1982 El-Habashy *et al.*, 1989
115.	*Cyperus michelianus*	Luteolin 7-glucuronide, luteolin 7-glucoside, luteolin 7-diglucoside, tricin 7-glucoside, tricin 7-diglucoside, sulphuretin	El-Habashy *et al.*, 1989
116.	*Cyperus microbolbos*	Luteolin 7-glucuronide	El-Habashy *et al.*,1989
117.	*Cyperus microiria*	α-Cadinol, α-cadinene	Bordoloi, 1998
118.	*Cyperus nervulosus*	Apigenin	Harborne *et al.*, 1982
119.	*Cyperus nipponicus* (Basal stem)	Cyperaquinone, remirol	Allan *et al.*, 1969 Morimoto *et al.*, 1999
120.	*Cyperus odoratus*	3-Cyclohexene-1-methanol, α-4-trimethylacetate, naphthalene, decahydro-4α-methyl-1-methylene-7-(1-methylethenyl)-, [4α-R-(4a-α-naphthalene, 1,2,3,4,4α,5,6,8α-octahydro-4α,8-dimethyl-2-(1-methylethenyl)-, caryophyllene oxide, squalene, cyclopropa[δ]naphthalen-3-one, octahydro-2,4α,8,8-tetramethyl-oxime, 3,7,11,15-tetramethyl-2-hexadecen-1-ol, 2-pentadecanone, 6,10,14- trimethyl, 9,12-octadecadienoic acid (Z,Z)-, octadecanoic acid, 2,3-dihydroxypropyl ester, 1(2H)-naphthalenone, octahydro-4,8α-dimethyl-6-(1- methylethenyl)-, (4-α-heptane, 2,4-dimethylnonane, 4,5-dimethyl, tetradecane, heptadecane,	Taiba *et al.*, 2022

		dichloroacetic acid, tridec-2-yl ester	
121.	*Cyperus papyrus*	α-Pinene, β-pinene, eucalyptol	Heba *et al*., 2014
		Luteolin 7-glucuronide	El-Habashy *et al*., 1989
		Octopamine	Smith, 1977
		6, 7-Dihydro-2, 3- dimethyl-5-cyclopentapyrazine	Cantalejo, 1997
		Pimpinellin	Harborne *et al*., 1993
		Caryophyllene oxide, cyperene, 1,8-cineole	Lawal *et al*., 2016
		Caryophyllene oxide, humulene epoxide II, aristolene, aromadendrene epoxide II	Lawal *et al*., 2016
	Cyperus papyrus (Rind and pith)	n-Hexadecanoic acid, cis-octadeca-9,12-dienoic acid, cis-octadec-9-enoic acid, n-octadecanoic acid, cis-octadeca-9,12,15-trienoic acid, phytadiene, squalene ergosta-3,5,22-triene, ergosta-3,5-diene, stigmasta-3,5,22-triene, stigmasta-3,5-diene, campesteryl dodecanoate, stigmasteryl dodecanoate, sitosteryl dodecanoate, campesteryl tetradecanoate, stigmasteryl tetradecanoate, sitosteryl tetradecanoate, campesteryl hexadecanoate, stigmasteryl hexadecanoate, sitosteryl hexadecanoate, campesteryl octadecanoate/oleate/linoleate, stigmasteryl octadecanoate/oleate/linoleate, sitosteryl octadecanoate/oleate/linoleate, campesteryl 3-O-β-D-glucopyranoside, stigmasteryl 3-O-β-D-glucopyranoside, sitosteryl 3-O-β-D-glucopyranoside, 7-oxo-campesteryl 3-O-β-D-glucopyranoside, 7-oxo-stigmasteryl 3-O-β-D-	Rosado *et al*., 2022

		glucopyranoside, 7-oxo-sitosteryl 3-O-β-D-glucopyranoside, campesteryl (6′-O-palmitoyl)-3-O-β-D-glucopyranoside, stigmasteryl (6′-O-palmitoyl)-3-O-β-D-glucopyranoside , sitosteryl (6′-O-palmitoyl)-3-O- β -D-glucopyranoside, campesteryl (6′-O-stearoyl/oleyl/linoleyl/linolenyl)-3-O-β-D-glucopyranoside, stigmasteryl (6′-O-stearoyl/oleyl/linoleyl/linolenyl)-3-O-β-Dglucopyranosidesitosteryl (6′-O-stearoyl/oleyl/linoleyl/ linolenyl)-3-O-β-D-glucopyranoside, n-eicosanol, n-heneicosanol, n-docosanol, n-tricosanol, n-tetracosanol, n-pentacosanol, n-hexacosanol, n-heptacosanol, n-octacosanol, oleic amide, triacontanamide, dotriacontanamide, tetratriacontanamide1-monohexadecanoyl glycerol, 1-monoheptadecanoylglycerol, 1-monooctadec-9,12,15-trienoylglycerol, 1-monooctadec-9,12-dienoylglycerol, 1-monooctadec-9-enoylglycerol, 1-monooctadecanoylglycerol, 1-mononoradecanoylglycerol, 1-monoeicosanoylglycerol α-tocopherol, β-tocopherol, γ-tocopherol, δ-tocopherol α-tocopheryl dodecanoate, α-tocopheryl tetradecanoate, α-tocopheryl hexadecanoate, α-tocopheryl oleate/linoleate, α-tocopheryl octadecanoate, α-tocopheryl eicosanoate, β-tocopheryl dodecanoate, β-tocopheryl tetradecanoate, β-tocopheryl hexadecanoate, β-tocopheryl oleate/linoleate, β-	

		tocopheryl octadecanoate, β-tocopheryl eicosanoate, γ-tocopheryl dodecanoate, γ-tocopheryl tetradecanoate, γ-tocopheryl hexadecanoateγ-tocopheryl oleate/linoleate, γ-tocopheryl octadecanoate, γ-tocopheryl eicosanoate, δ-tocopheryl dodecanoate, δ-tocopheryl tetradecanoate, δ-tocopheryl hexadecanoate, δ-tocopheryl oleate/linoleate, δ-tocopheryl octadecanoate, δ-tocopheryl eicosanoate phytol, phytyldodecanoate, phytyltridecanoate, phytyltetradecanoate, phytyl pentadecanoate, phytylhexadecanoate, phytyl heptadecanoate, phytyl octadeca-9,12,15-trienoate, phytyl octadeca-9,12-dienoate, phytyl octadec-9-enoate, phytyloctadecanoate, phytylnonadecanoate, phytylheneicosanoate, phytyldocosanoate, phytyltricosanoate, phytyl, tetracosanoate, phytylpentacosanoate, phytyl hexacosanoate2-monohexadecanoylglycerol, 2-monotetracosanoylglycerol, 2-monohexacosanoylglycerol, 2-monooctacosanoylglycerol, 2-monotriacontanoylglycerol1,2-dipalmitin, 1,3-dipalmitin, 1,2-palmitoylolein, campestanol, campesterol, stigmasterol, sitosterol, stigmastanol, Δ^5-avenasterol, Δ^7-stigmastenol, 7-oxo-campesterol, 7-oxo-stigmasterol, 7-oxo-sitosterol, ergostane-3,5,6-triol, sitostane-3,5,6-triol, ergosta-3,5-dien-7-	

		one, ergost-4-en-3-one, ergosta-4,6-dien-3-one, stigmast-4-en-3-one, ergostane-3,6-dione, stigmastane-3,6-dione trans-octadecyl ferulate, trans-eicosanylferulate, trans-docosanylferulate, trans-tetracosanylferulate, trans-hexacosanylferulate, trans-octacosanylferulate, trans-feruloyloxyeicosanoic acid, trans-feruloyloxyheneicosanoic acid, trans-feruloyloxydocosanoic acid, trans-feruloyloxytricosanoic acid, trans-feruloyloxytetracosanoic acid, trans-feruloyloxypentacosanoic acid, trans-feruloyloxyhexacosanoic acid, trans-feruloyloxyheptacosanoic acid, trans-feruloyloxyoctacosanoic acid, 1-mono-trans-feruloyloxyeicosanoylglycerol, 1-mono-trans-feruloyloxydocosanoylglycerol, 1-mono-trans-feruloyloxytetracosanoylglycerol, 1-mono-trans-feruloyloxyhexacosanoylglycerol, 1-mono-trans-feruloyloxyoctacosanoylglycerol, 1-mono-trans-feruloyloxytriacontanoylglycerol	
122.	*Cyperus perangustus*	Apigenin	Harborne *et al.*, 1982
123.	*Cyperus pilosus*	α-Cadinol, luteolin, luteolin 5-methyl ether, cyperaquinone	Bordoloi, 1998
124.	*Cyperus platystylis*	Dihydrocyperaquinone	Allan *et al.*, 1969
125.	*Cyperus polystachyos*	Luteolin 5-methyl ether	Harborne *et al.*, 1982
126.	*Cyperus procerus*	Luteolin, tricin	Harborne *et al.*, 1982
127.	*Cyperus prolifer*	Mangiferin, isomangiferin, quercetin	Harborne *et al.*, 1982
128.	*Cyperus prolixus*	Caryophyllene oxide, α-cyperone,	Zoghbi *et al.*, 2006

		14-hydroxy-9-epi-β-caryophyllene	
129.	*Cyperus pygmaeus*	Luteolin, tricin	Harborne *et al.*, 1982
130.	*Cyperus reflexus*	Luteolin 5-methyl ether	Harbone *et al.*, 1982
131.	*Cyperus rigidellus*	Quercetin 3-methyl ether, quercetin 3,7-dimethyl ether, kaempferol 3,7-dimethylether	Harbone *et al.*, 1982
132.	*Cyperus rotundus*	Monoterpenoids, sesquiterpenoids, diterpenoids, triterpenoids, steroids, aliphatic acid derivatives, aurones, chromones, coumarins, iridoids, flavonoids, stilbenoids, lignans, benzofurans, phenolic acids, phenyl propanoids, glycols, sesquiterpene alkaloids, organic acids, aliphatic acids, aliphatic ketones, amides	*Elaborated in chapter 7*
133.	*Cyperus rutilans*	Hydroxydietrichequinone	Allen *et al.*, 1978
134.	*Cyperus sanguinolentus*	Luteolin 5-methyl ether	Harbone *et al.*, 1982
135.	*Cyperus scaber*	Scabiquinone, dihydroscabequinone, scaberin	Allen *et al.*, 1978
136.	*Cyperus scariosus*	trans-Pinocarveol, δ-cadinene	Pandey, 2002 Bordoloi, 1998
		Leptosidin-6-O-β-D-glucopyranosyl-O-α-L-rhamnopyranoside, leptosidin-6-xylosyl-(1,4)-arabinoside	Bhatt *et al.*, 1981
		Caryophyllene oxide	Pandey, 2002
		β-Selinene	Kiuchi, 1983
		Rotundene, rotundenol	Uppal, 1984
		Aromadendrene, alloaromadendrene	Pandey, 2002
		α-Gurjunene	Fraga, 1992
		Aristolone	Ha *et al.*, 2002
		Asiatic acid	
		epi-Guaipyridine, guaia-9,11-dienpyridine, cananodine, cyperen-8-one, cyperolactone, rotundone	Clery *et al.*, 2016
		α-Pinene, thuja-2,4(10)-diene, β-	Bezerra *et al.*, 2019

		pinene, myrcene, p-cymene, limonene, eucalyptol, pinol, p-cresol, p-cymenene, guaiacol, linalool, α-fenchol, cis-rose oxide, nopinone, trans-pinocarveol, trans-pinocamphone, pinocarvone, 4-ethylphenol, *cis*-pinocamphone, terpinen-4-ol, α-terpineol, myrtenal, myrtenol, verbenone,trans-dihydrocarvone, 4-vinyl-phenol, carvone, geraniol, cyprotene, α-cubebene, cyperadiene, cyclosativene, isopatchoula-3,5-diene, α-copaene, isolongifolene, β-cubebene, (E)-α-damascone, cyperene, ylanga-2,4(15)-diene, caryophyllene, nor- rotundene, α-copaene, patchoula-2,4(15)-diene, α-guaiene, α-humulene, rotundene, aristolochene, γ-gurjunene, γ-muurolene, 7-epi-selina-4,11-diene, β-selinene, valencene, α-selinene, α-muurolene, isorotundene, δ-guaiene, nootkatene, 7-epi-α-selinene, δ-cadinene, cyperene epoxide, α-calacorene, tetramethyl-4,5,6,7,8,8a-hexahydro-1H-3a,7-methanoazulen-4-ol, β-calacorene, β-caryophyllene oxide, β-caryophyllene oxide, brachyloxide, cyperen-6-ol, humulene epoxide II, cyperen-8-one, cyperen-6-one, cubenol, caryophylla-3(15),7(14)-dien-6-ol, nor-cyperen-4-one, cadalene, mustakone, cyperotundone, rotundone, cis-β-patchoulenone, rotundan-12-one, cyperenal, α-cyperone, nootkatone, cyperolactone, cyperenol, scariodione, patchoulenone, 3-isopatchoulene	
137.	*Cyperus*	Luteolin 7-glucoside, luteolin 7-	El-Habashy *et al.*,

	schimperianus	diglucoside	1989
138.	*Cyperus serotinus*	Calamenene, δ-cadinene	Bordoloi,1998
139.	*Cyperus sexflorus*	Kaempferol 3-methyl ether	Harborne *et al.*, 1982
140.	*Cyperus squarrosus*	Quercetin	Harborne *et al.*, 1982
141.	*Cyperus stoloniferus*	trans-Resveratrol, piceatannol	Chau *et al.*, 2013
		Cyperene, caryophyllene oxide	Dung *et al.*, 1995
		Cyperaquinone, hydroxy cyperaquinone	Allan *et al.*, 1978
142.	*Cyperus subulatus*	Cyperaquinone, hydroxy cyperaquinone	Allan *et al.*, 1978
143.	*Cyperus sulicinux*	Apigenin	Harborne *et al.*, 1982
144.	*Cyperus tegetum*	Stigmasterol, 12-O-tetradecanoylphorbol-13-acetate, 7,12-dimethylbenz (α) anthracene	Chatterjee *et al.*, 2022
145.	*Cyperus teneriffae*	Eugenitin, tamarixetin, ombuin, 5,7,30,50-tetrahydroxyflavanone, 4,6,30,40-tetramethoxy aurone, 30-hydroxy-4,6,40-trimethoxy aurone, 1-(2,3-dihydro-6-hydroxy-4,7-dimethoxy-2S-(prop-1-en-2-yl) benzofuran-5-yl) ethenone, 2S-isopropenyl-4,8-dimethoxy-5-hydroxy-6-methyl-2,3-dihydrobenzo [1,2-β;5,4-β] difuran	Angel *et al*., 2011
146.	*Cyperus tenuiculmis*	Aureusidin, quercetin, luteolin 5-methyl ether	Harborne *et al.*, 1982
147.	*Cyperus tenuispica*	Mangiferin, isomangiferin, quercetin	Harborne *et al.*, 1982
148.	*Cyperus tetraphyllus*	Quercetin 3-methyl ether, kaempferol 3-methyl ether	Harborne *et al.*, 1982
149.	*Cyperus thunbergii*	Thunbergin A-B, aureusidin, resveratrol, trans-scirpusin A, trans-cyperusphenol A, luteolin	Arakki *et al.*, 2021
150.	*Cyperus trinervis*	Luteolin 5-methyl ether	Harborne *et al.*, 1985
151.	*Cyperus tuberosus*	δ-Cadinene, α-copaene	Komai *et al.*, 1994
		α-Humulene, humulene epoxide II, β-caryophyllene, caryophyllene oxide	Ekundayo *et al.*, 1991
152.	*Cyperus vaginatus*	Cyperaquinone, hydroxy	Allen *et al.*, 1978

		cyperaquinone	
153.	*Eleocharis microcarpa*	11 Hydroxy-14-(3,5-dihydroxy-2-methyl cyclopentyl)-tetradec-9-ene-12-yn eoic acid	Van Aller *et al.*, 1983
154.	*Kobresia nepalensis*	Nepalensinol A-G	Yamada *et al*., 2006
155.	*Kyllinga alba*	Luteolin, pelargonidin	Williams and Harborne, 1977
		Manoyl oxide, 13-epi-manoyl oxide, 11α-hydroxymanoyl oxide, 1β-hydroxymanoyl oxide	Guilhon *et al*., 2008
156.	*Kyllinga brevifolia*	Okanin Quercetin-3-O-β-apiofuranosyl 2-β-Glucopyranosyl-7-O-α-rhamnopyranosylvitexin Kaempferol 3-O-β-apiosyl-(1-2)-β-glucoside, isorhamnetin 3-O-β-apiosyl-(1-2)- β-glucoside, quercetin 3-O-β-apiofuranosyl-(1-2)- β-glucopyranoside 7-O-α-rhamnopyranoside,occadinol, τ-muurolol, germacrene D-4-ol	Apers *et al*., 2002
		Occadinol, τ-muurolol, germacrene D-4-ol	Paudel *et al*., 2012
	Kyllinga brevifolia var. *leiocarpus*	epi-Afzelechin, orientin, quercetin, vitexin	Lew *et al*., 1998
157.	*Kyllinga crassipes*	Cyanidin, luteolin, tricin	Williams and Harborne, 1977
158.	*Kyllinga erecta*	Myristic acid, octadeca-9-12-dienoic acid, tetradecanoic acid, octanoic acid, palmitic acid, pentadecanoic acid, ambreinolide, nor-ambreinolide, β-bourbonene, capric acid, caryophyllene oxide, β-caryophyllene, 1-8 cineol, α-copaene, cyperene, cyperotundone, β-elemene, hexahydro farnesyl acetone, germacrene D, lauric acid, manoyl oxide, 1-β-hydroxy manoyl oxide, 11-α-hydroxy	Dolmazon *et al.*, 1995 Dolmazon *et al.*, 2001 Mahmout *et al*., 1993 Mahmout *et al*., 2001

		manoyl oxide, 11-oxo manoyl oxide, 13-epi manoyl oxide, 13-epi 11-α-hydro manoyl oxide, 13-epi16-hydroxy manoyl oxide, 16-hydroxy manoyl oxide, β-pinene, sativene, β-selinene, spathulenol, thymol methyl ether	
159.	*Kyllinga monocephala*	σ-Cyperone, β-selinene, α-humulene, α-cadinol, caryophyllene oxide, α-muurolol, α-atlantone	Raju *et al.*, 2007
		α-Cyperone, β-selinene, α-humulene	Komai and Tang, 1989
160.	*Kyllinga odorata*	Myricitrin, quercetin, luteolin, chrysin	Bezerra *et al.*, 2019
		Dihydrokaranone, aristolochene	Tucker *et al.*, 2006
161.	*Kyllinga pumila*	Methyl E,E-10,11-epoxyfarnesoate, β-elemene, Z-caryophyllene, germacrene D, E-caryophyllene	Jaramillo-Colorado *et al.*, 2016
162.	*Kyllinga triceps*	Caryophyllene, β-sitosterol, stigmasterol, ferruginol, eudesmol, quercetin, rutin	Abhijeet Vishnu Puri, 2022 Verma *et al.*, 2017
163.	*Lepidosperma* sp. *Montebello*	3-O-Prenylpiceatannol, 3-O-prenyl-3'-O-methyl piceatannol, p-coumarate ester, (E)-2,4-bis(3-methyl-2-buten-1-yl)-3,30,40,5-tetrahydroxystilbene, (E)-2,6-bis(3-methyl-2-buten-1-yl)-3,4,5-trihydroxy-30-methoxystilbene, 2-prenyl-3-methoxy-5-hydroxy-E-stilbene	Duke *et al.*, 2016 Abu-Mellal *et al.*, 2012
164.	*Oxycaryum cubensis*	Catechin, chlorogenic acid, luteolin	Bezerra *et al.*, 2019

165.	*Rhynchospora corymbosa* (Whole plant)	Oleanane 3-(3'R-hydroxy)-hexadecanoate, β-sitosterol, β-sitosterol glycoside, oleanolic acid, trans-cinnamic acid, dendrotriol, (24R)-24-ethyl-5α-cholestane-3β,5,6β-triol, glycerol, docosanoic acid 2-hydroxy-1-hydroxymethyl-ethyl ester, tricin, diacetyl tricin, monoacetyl tricin	Annie *et al*., 2016
		Myricitrin, quercetin, luteolin, chrysin, catechin, apigenin	Bezerra *et al*., 2019
166.	*Scirpus californicus*	Piceatannol, scirpusin A, scirpusin B	Schmeda Hirschmann *et al*., 1996
167.	*Scirpus cubensis*	Catechin, chlorogenic acid, rutin, luteolin, apigenin	Bezerra *et al*., 2019
168.	*Scirpus fluviatilis*	trans-Resveratrol, piceatannol, scirpusin A-B, 3,3',4,5'-tertrahydroxy stilbene	Nakajima *et al*., 1978
169.	*Scirpus holoschoenus*	Scirpusin B, cyperusphenol	Arakki *et al*., 2017
		2-Prenyl-3,5,4'-trimethoxystilbene, 2-prenyl-3-hydroxy-5,4'-dimethoxystilbene, 2-prenyl-3,4'-dihydroxy-5-methoxy-stilbene, 3,5,4'-trimethoxystilbene	Abdel-Mogib *et al*., 2001
		Luteolin, morine, tricine	Noori *et al*., 2012
170.	*Scirpus lacustris*	Apigenin, kaempferol, luteolin, morine, quercetin, rutin, tricine	Noori *et al*., 2012
171.	*Scirpus litoralis*	β-Sitosterol, quercetin 3-β-glucoside, quercetin 3,7-β-diglucoside, isorhamnetin 3,7-β-glucoside	Nassar *et al*., 2000
		Apigenin, chrysin, kaempferol, luteolin, morine, myricetin, quercetin, tricine	Noori *et al*., 2012
172.	*Scirpus maritimus*	trans-Resveratrol, ε-viniferin, piceatannol, scirpusin A-B	Powell *et al*., 1987
		Myricetin, quercetin, rutin, vitexin, trans-resveratrol, ε-viniferin, scirpusin A, scirpusin B	Noori *et al*., 2012
173.	*Scirpus multicaule*	Luteolin, morine, quercetin, tricine	Noori *et al*., 2012
174.	*Scirpus nodosus*	Aureusidin	Clifford and Harborne, 1969

			Abdel-Mojib *et al.*, 2001
175.	*Scirpus tuberosus*	Lupeol, betulin, betulinaldehyde, apigenin, β-sitosterol	Nassar *et al.*, 2000
176.	*Scirpus wichurai*	Quercetin, kaempferol, apigenin, luteolin	Abdel-Mojib *et al.*, 2001
177.	*Scirpus yagara*	trans-Resveratrol, scirpusin A-B, p-hydroxycinnamic acid	Yang *et al.*, 2010
178.	*Scleria hirtella*	Nonanal, geranial, neral	Maia *et al.*, 2005
179.	*Scleria lithosperma*	α-Pinene, 1,8-cineole, cyclosativene, β-cedrene, cis-thujopsene, β-barbatene, aromadendrene, α-acoradiene, cuparene, δ-cadinene, γ-cuprenene, elemol, caryophyllene oxide, cedrol, neo-intermedol, neocembrene, myristic acid, palmitic acid, linoleic acid, oleic acid, stearic acid	Rameshkumar *et al.*, 2009
180.	*Scleria striatinux*	Okundoperoxide, sclerienone A-B	Kennedy *et al.*, 2008
		Benznidazole, miltefosine, melarsoprol, podophylotoxin	Kennedy *et al.*, 2017
		Sclerienone C	Kennedy *et al.*, 2016
		α-Pinene, β-pinene, cyperene	Mve-Mba*et al.*, 1996
		Okundoperoxide	Mbah *et al.*, 2012
	Scleria striatinux (Fruit)	Caprylic acid, capric acid, palmitic acid, α-linolenic acid, linoleic acid	Abdou Bouba *et al.*, 2016

Phenolic compounds reported from Cyperaceae members

Literature review revealed that, in addition to the volatile chemicals, the Cyperaceae have been investigated generally for their polyphenols such as phenolic acids, benzoic acids, cinnamic acids, flavonoids, stilbenes, aurones and quinones (Clifford and Harborne, 1969; Harborne, 1971; Williams, and Harborne, 1977; Harborne *et al.*, 1982; Harborne *et al.*, 1985; El-Habashy *et al.*, 1989). The availability of standard polyphenol compounds, and the established extraction and analytical protocols make polyphenols an easy target for phytochemical analysis. Investigation of polyphenolics has significance in chemotaxonomy, nutritional, medicinal and ecological aspects. Plants having different types of polyphenolic compounds have been used as potential therapeutics due to the anti-oxidative, anti-cancerous and anti-inflammatory properties associated with the polyphenolics (Gil *et al*., 2000).

Flavonoids

Flavonoids are the most widely distributed phenolic compounds in Cyperaceae members (**Table 1, Figure 1**). The two-dimensional chromatographic analysis by Harborne (1971) revealed the presence of five pharmacologically important flavonoids such as kaempferol, quercetin, glycoflavone, luteolin and tricin in the leaves of different members of the tribe *Scirpae*, *Rhynchosporae* and *Cypereae*. El-Habashy *et al*. (1989) investigated 20 *Cyperus* and four *Pycreus* species for their flavonoids and glycosides and the data was used for chemotaxonomy. Recent phytochemical investigation using HPLC revealed the presence of gallic acid, phloroglucinol, catechin, caffeic acid, coumaric acid, ferulic acid, rosmarinic acid, quercetin and biochanin in different *Carex* species (Rajak and Ghosh, **2022**). The coumarin remirol and the quinones cyperaquinone and scabequinone were identified as the antifeedant compounds in the stem of *Cyperus nipponicus* and *Cyperus distans* (Morimoto *et al*., 1999).

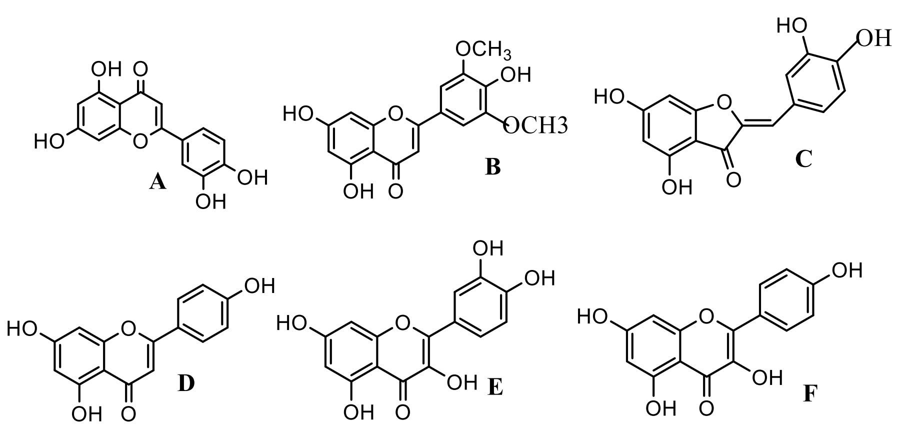


Figure 1. Major flavonoids reported from *Cyperaceae* species. **A-** Luteolin, **B-** Tricin, **C-** Aureusidin, **D-** Apigenin, **E-** Quercetin and **F-** Kaempferol

Gamal *et al.* (2015) reviewed the phenolics in *Cyperus* species. Among the different flavonoids, luteolin is present in around 120 *Cyperus* species, while luteolin derivatives such as glycosides and methyl ethers were also abundant in various *Cyperus* species. The O-methylated flavone tricin is another widely distributed flavonoid compound reported in around 90 *Cyperus* species. The tetrahydroxy aurone 'aureusidin' is reported from around 60 *Cyperus* species. Apigenin, quercetin and kaempferol are other major flavonoids reported from Cyperaceae members (Gamal *et al.*, 2015).

Stilbenes in Cyperaceae members: Among the polyphenolic compounds, stilbene derivatives are important bioactive components reported in several Cyperaceae species (Gamal *et al.*, 2015; Giri *et al.*, 2015; Dávid *et al.*, 2021). Stilbenes with 1,2-diphenylethylene nucleus is a class of plant phenolics that occur in a number of heterogeneous and phylogenetically unrelated plant families such as Cyperaceae, Dipterocarpaceae, Gnetaceae, Leguminosae, Polygonaceae and Vitaceae. Stilbenes, formed by the general phenylpropanoid pathway, are found as monomers, dimers and complex oligomers. Stilbenes are important from chemotaxonomic point of view, and they play a key role in plant defence mechanisms as well. The compounds are attributed with several pharmacological properties, and the monomeric stilbene trans-resveratrol is one of the most important bioactive phytochemicals with prominent role in the prevention and treatment of neurodegenerative diseases, diabetes and cancer. Resveratrol, the active molecule of red wine, is present in more than 70 plant species. Piceatannolis a monomeric stilbene, while scirpusins are dimerized stilbenes.

Stilbenes can be found in relatively high amounts in several Cyperaceae species, for instance the total content of stilbenes in the roots and rhizome of *Carex fedia* var. *miyabei* was estimated over 0.15% (w/w of fresh material), and in case of *Carex pumila*, the main constituent was miyabenol A present at 0.23% (w/w of dried material) in the plant. Dávid *et al.* (2021) has reviewed around 70 stilbenoids from 28 Cyperaceae members, of which around 18 were isolated from *Carex distachya*. Scirpusins A and B are abundant stilbene dimers in *Scirpus* and *Cyperus* species. *Cyperus longus*, *Cyperus capitatus*, *Cyperus conglomerates* and *Cyperus rotundus* are also reported to possess stilbenoids (Gamal *et al.*, 2015; Majeed *et al.*, 2022).

The major stilbene derivatives reported from Cyperaceae plants are; hydroxy stilbenes (resveratrol, carexinols, scirpusins, 3,3',4,5'-tertrahydroxystilbene), prenylstilbenoids (carexanes), tetrastilbenes(cis-miyabenol A) and oligostilbenes (kobophenols, pallidolviniferins, smiglasids, virgatanol and piceatannol) (**Figure 2)** (Meng *et al.*, 2001; Lee *et al.*, 2013; Rajak and Ghosh, 2022). As Cyperaceae members are very good sources of a wide variety of stilbenes, and several of them occur in large quantity, they are worthy for further phytochemical and pharmacological investigations.

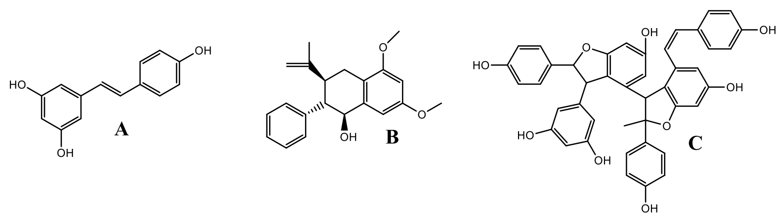


Figure 2. A- Hydroxy stilbene, resveratrol, **B-** Prenyl stilbene, carexane, and**C-** Tetrastilbene, cis-miyabenol A

Discovery of novel prenylated cinnamates and stilbenes in *Lepidosperma* sp. Propolis is the natural resinous mixture produced by honeybees from plants exudates, and is attributed with potential bioactivities, mainly due to the presence of characteristic polyphenols. The composition of propolis varies region wise, depending on the vegetation around. Propolis samples collected from the beehives of Kangaroo Island, Australia was found to have novel compounds belonging to prenylated cinnamate and stilbene classes (Abu-Mellal *et al.,* 2012). Ligurian honey bees, *Apis mellifera* sub sp. *ligustica* Spinola, were found to produce the propolis from the resin exuded by the Australian native sedge plant *Lepidosperma* sp. Montebello (Cyperaceae). There had been no previous reports of bees foraging for propolis on plants of the Cyperaceae family so these widespread plants had not been considered a likely source. Samples of plant exudates, resinous material carried on bee legs, and freshly deposited propolis in the hive were analysed by TLC and high field ^{1}H NMR spectroscopy, and found to be with similar chemical profile, with prenylated cinnamate and stilbene compounds (**Figure 3)** (Duke *et al.*, 2017).

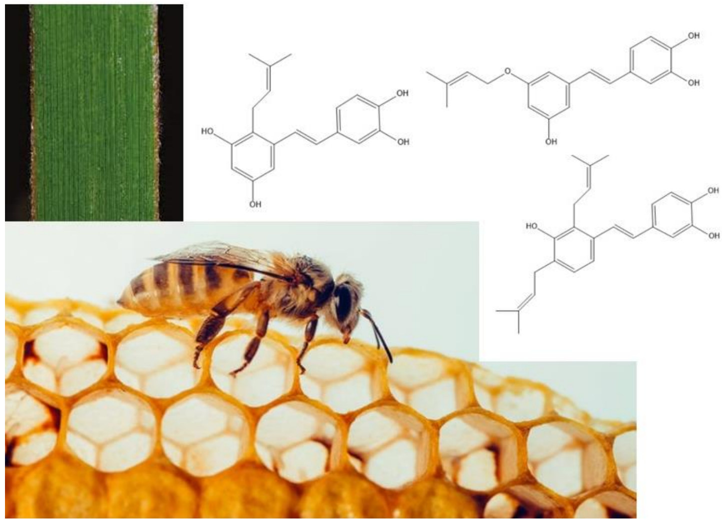


Figure 3. Honey bee, propolis and stilbenes in *Lepidosperma* species

Coumarins in Cyperaceae members

Diversity of coumarin structures such as umbelliferone, xanthotoxol, 7-(γ,γ-dimethylallyloxy)-8-methoxycoumarin, 7-methoxy-8-(γ,γ-dimethylallyloxy) coumarin, 5,7-dimethoxy-8-(γ,γ-dimethylallyloxy) coumarin, prenyletin, leptodactylone, 5,7,8-trimethoxycoumarin, 7,8-dimethoxycoumarin, 5,7-dimethoxycoumarin, scopoletin, and isoscopoletin have been reported from various *Cyperus* species such as *Cyperus alopecuroides*, *Cyperus incompletes* and *Cyperus papyrus* (**Figure 4)** (Mohamed *et al*., 2015).

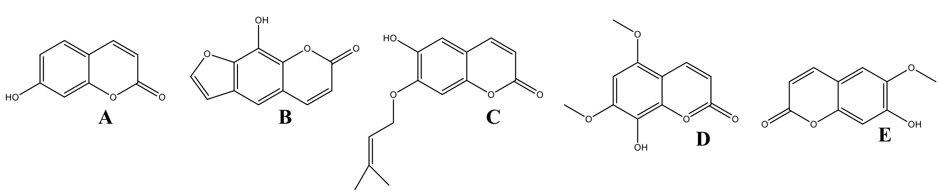


Figure 4. Coumarins reported from Cyperaceae members. **A-** Umbelliferone, **B-** Xanthotoxol, **C-** Prenyletin, **D-** Leptodactylone, and **E-** Scopoletin

Quinones in Cyperaceae members: Cyperaceae members have been shown to be prolific source of quinones with wide structural diversity such as difuran benzoquinones (Allan *et al.,* 1969; Allan *et al.,* 1978; Nassar *et al.,* 2002). Cyperaquinone, conicaquinone, scabiquinone, breviquinone, capiquinones and alopecuquinone are the major quinones reported from various Cyperaceae members (**Figure 5)** (Gamal *et al.*, 2015).

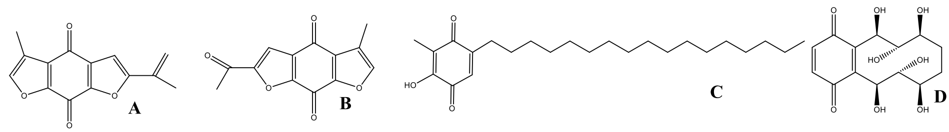


Figure 5. Major quinones reported from Cyperaceae members. **A-** Cyperaquinone, **B-** Scabiquinone, **C-** Capiquinone, and **D-** Alopecuquinone

Cyperus capitatus contains a homologous series of 11 6-alkyl-2-hydroxy-3-methyl-1,4-benzoquinones, with chain length C17 to C27 (Alves *et al.*, 1992).

Sesquiterpenoids in Cyperaceae members

Sesquiterpenoids are abundant in the essential oils of various Cyperaceae members. *Cyperus articulates*, a common medicinal and aromatic species yielded several interesting sesquiterpenoids such as isopatchoul-4 (5) en-3-one, corymbolone, α-corymbolol, mandassidione, isopatchoulenone and mustakone (Nyasse *et al.*, 1988). The systematic approach on the structure elucidation of complex sesquiterpenoids using conventional characterization techniques was revealed by the revision of the structure of the bicyclic ketone articulone isolated from *Cyperus articulates* to isopatchoul-4 (5) en-3-one. Couchman *et al*. (1964) proposed the structure as the bicyclic ketone articulone, which was further reinvestigated by Nigam (1965), Hikino *et al*. (1965), Nerali *et al*. (1965) and Neville *et al*. (1968) and confirmed the structure as isopatchoul-4 (5) en-3-one. *Scleria striatonux* rhizomes afforded novel bicyclic cyclofarnesyl endoperoxide class of sesquiterpenoids; okundoperoxide, sclerienone A-C (**Figure 6)** (Kennedy *et al.*, 2016).

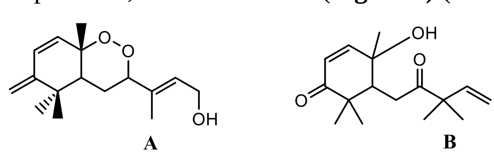


Figure 6. Bicyclic cyclofarnesyl endoperoxide **A-**Okundoperoxide, **B-**Sclerienone A

Diterpenoids inCyperaceae members

Various Cyperaceae members have been reported as rich source of diterpenoids as well. The diterpenoids manoyloxide, 16-hydroxymanoyloxide, llα-hydroxymanoyloxide, lβ-hydroxymanoyloxide, ambreinolide and norambreinolide were reported from *Kyllinga erecta* (**Figure 7)** (Dolmazon *et al*., 1995).

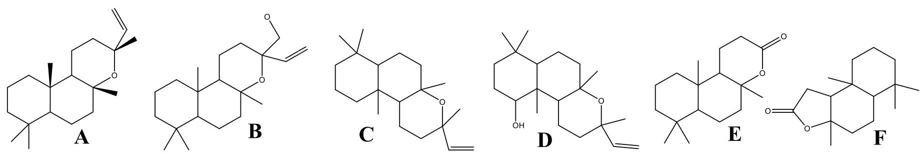


Figure 7. Major diterpenoids reported from *Kyllingaerecta*- **A-**Manoyloxide, **B-** 16-Hydroxymanoyloxide, **C-** llα-Hydroxymanoyloxide, **D-** lβ-Hydroxymanoyloxide, **E-** Ambreinolide and **F-** Norambreinolide

Fatty acids in Cyperaceae members

Fatty acids are extracted from the crude plant material by hexane solvent, and analysed by the GC-MS of volatilised Fatty Acid Methyl Esters (FAME). Generally, Cyperaceae members have the C18:3 fatty acid biosynthetic pathway as prominent. *Cyperus esculentus* is the major oil rich Cyperaceae member, and several reports are there on the oil composition of *Cyperus esculentus* (Lopéz-Cortés *et al.*, 2013). Ekeanyanwu and Ononogbu (2010) reported that the lipid found in *Cyperus esculentus* is non-drying and suitable for soap making. The fatty acid composition of *Cyperus esculentus* tuber oil (chufa oil) included oleic acid 689.2-732.9 g kg^{-1}, palmitic acid 125.5-141.2 g kg^{-1} and linoleic acid 99.6-154.6 g kg^{-1}, which is comparable with that of olive oil (**Figure 8)** (Coşkuner *et al.*, 2002).

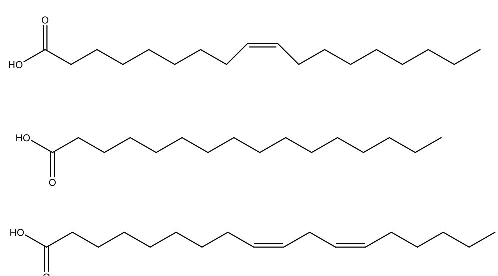


Figure 8. The major fatty acids in *Cyperus esculentus,* oleic acid, palmitic acid and linoleic acid

The fatty acid profile of the leaves of *Cyperus laxus* showed palmitic acid, octadecanoic acid, oleic acid and eichosanoic acid. Casado *et al.*, (2015) showed that the weathered hydrocarbons drastically affect the lipidic composition of *Cyperus laxus* at the fatty acid level, suggesting that this species adjusts the lipid composition in its vegetative organs, mainly in roots, in response to the weathered hydrocarbon presence and uptake during the phytoremediation process. Bogucka-Kocka and Janyszek (2010) examined the fatty acid profiles of 13 *Carex* species and found linoleic acid, oleic acid, α-linolenic acid and palmitic acid as the major fatty acids.

For papyrus (*Cyperus papyrus*), the lipid content accounted for 4.1% in the rind and 4.9% in the pith, and several lipidic compounds such as hydrocarbons, fatty acids, 2-hydroxyfatty acids, fatty alcohols, phytol, phytol esters, alkylamides, glycerides, steroids, tocopherols and ferulates (Rosado *et al.*, 2022). n-Hexadecanoic acid, cis, cis-octadeca-9,12-dienoic acid, cis-octadec-9-enoic acid, n -octadecanoic acid, cis, cis-octadeca-9,12,15-trienoic acid were the major fatty acids in rind and pith of the plant.

Phytochemistry of *Cyperus* species other than *Cyperus rotundus*

In addition to *Cyperus rotundus,* few other *Cyperus* species such as *Cyperus esculentus,Cyperus scariosus,Cyperus conglomeratus,Cyperus distans,Cyperus articulatus* and *Cyperus longus* have also been investigated in detail for the constituents. Gamal *et al.* (2015) and Taheri *et al.* (2021) have summarized the phytochemicals of different *Cyperus* species. Literature review revealed that 97*Cyperus* species have been investigated for their phytochemicals (**Table 1**). In addition to *C. rotundus, C. alopecuroides, C. alternifolius, C. articulates, C. conglomerates, C. difformis, C. dubius, C. esculentus, C. laevigatus, C. longus* and *C. scariosus* are the major species investigated for the phytochemicals.

***Cyperus esculentus*:** The plant, also known as tiger nut, earth almond or yellow nut sedge, has sweet tubers and reported to have health and nutritional benefits (Venkatachalam and Sathe, 2006; Zhang *et al.*, 2022). The plant is also considered as the world's 16^{th} worst weed (Holm *et al.*, 1977). The plant was cultivated in the Nile valley by ancient Egyptians, and was discovered in tombs in Egypt, and now the plant is being cultivated in several countries across the world, especially the Eastern Hemisphere, as animal feed, side dish for human consumption, and for preparing the beverage *Horchata*. The plantexists in three varieties; black, brown and yellow, amongst which the yellow one is the most solicited for human and animal consumption.

The plant has been reviewed intensively for its chemical constituents and potential biological activities (Zhang *et al.,* 2022). The findings of recent research showed high content of nutrients and bioactive phytochemicals such as alkaloids, glycosides, flavonoids, crude fibres, tannins, proteins, carbohydrates, oxalates, phytates and fats in tiger nut. The tuber is particularly rich in fixed oil, with high oleic acid content. The tuber of *Cyperus esculentus* is used as a snack and also for making a sweet and tasty beverage. *Horchata de chufa* is a traditional Spanish beverage produced from tiger nuts, and the drink is popular in Spain (Pascual *et al.,* 2000). In Cameroon, more than 17,000 tons tiger nuts are produced per year (Djomdi *et al.,* 2013). In Spain, around 8,360 tons of dried tiger nuts are produced annually, and the annual value of production in Spain has risen to 3.3 million Euros (Carlos *et al.,* 2022; Pelegrin *et al.,* 2022; *Zhang et al*., 2022).

The plant is a potential source of carbohydrates, fiber and polyphenols, and could be used as potential ingredients in the food industry (María del Carmen Razola-Díaz *et al.,* 2022). Tiger nuts are rich in carbohydrates (58.9%), lipids (24.5%), calcium (100.2 mg/100g), potassium (487.1 mg/100g), phosphorus (128.6 mg/100g), magnesium (94.8 mg/100g), but poor in proteins (8.1%) and zinc (4.0 mg/100g) (Okoye and Ene, 2018). Both the volatile and non-volatile phytochemicals were investigated in detail. The rhizome oils of two varieties (brown and black) of Nigerian *Cyperus esculentus* were found to be potential sources of α-pinene (70.5-75.5%). In addition, different chemotypes have also been reported for these species (Kubmarawa *et al.,* 2005). Investigation of the ethanolic extracts identified more than 40 polyphenols with promising medicinal applications (Olukanni *et al*., 2022; Pelegrin *et al.,* 2022; Diaz *et al*., 2022).

Cyperus scariosus: Tubers of the plant is the source of cypriol oil, the essential oil with ambery, balsamic, spicy, warm and woody notes, which is widely applied in various perfumes and medicines and of high demand in perfume industry (Bhawna *et al.,* 2013; Kumar *et al.,* 2016). Kumar *et al.* (2016) analysed *Cyperus scariosus* oils from 13 locations in India and the oil yield varied from 0.2 to 0.5 %v/w. The major compounds were cyperene, longifolin, caryophyllene oxide and longiverbenone. Characteristic nitrogenous components such as epi-guaipyridine, guaia-9,11-dienpyridine and cananodine have been reported from *Cyperus scariosus* oil (**Figure 9)** (Clery *et al.,* 2016). Rotundone was found as the volatile compound responsible for the woody amber odour of cypriol oil together with other ketones such as cyperen-8-one (Clery *et al.*, 2016).

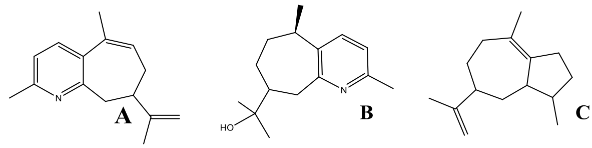


Figure 9. Major nitrogenous components and odoriferous components identified in *Cyperus scariosus* essential oil. **A-** epi-Guaipyridine, **B-** Guaia-9,11-dienpyridine, **C-** Cananodine

Cyperus articlulatus: The tropical sedge *C. articlualtus* is widely used in traditional medicine, as well as in perfumery. Characteristic sesquiterpenoids such as isopatchoul-4 (5) en-3-one, corymbolone, α-corymbolol and mandassidione were isolated from the rhizome essential oil (**Figure 10)** (Nyasse, 1988). The sesquiterpenoids cyperotundone, mustakone, 1,2-dehydro-α-cyperone and sesquichamaenol were identified as lead molecules in *Cyperus articulatus* with antiseizure activity (Brillatz *et al*., 2020).

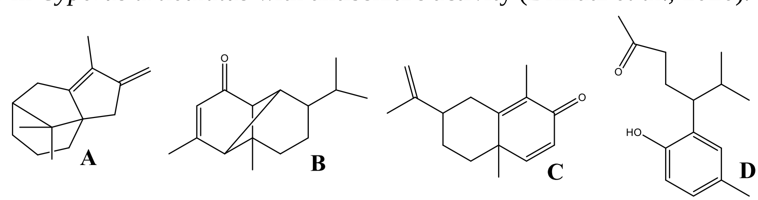


Figure 10. Sesquiterpenoids reported from *Cyperus articulatus* with antiseizure activity. **A-** Cyperotundone, **B-** Mustakone, **C-** 1,2-Dehydro-α-cyperone, and **D-**Sesquichamaenol

Cyperus conglomeratus: The plant is another important *Cyperus* species with wide distribution, especially in the extreme dessert conditions, and has traditional medicinal uses such as analgesic, diuretic, stimulant, pectoral, emollient and anthelmintic and revealed pharmacological activities such as antimicrobial and anti-candidal properties. Cyperene was the major component of the rhizome essential oil of *Cyperus conglomeratus* collected from Iran (Feizbakhsh and Naeemy, 2011). In additional to essential oils, several metabolites such as flavonoids, triterpenoids, steroids and aromatic shikimates were isolated and characterized from the species (Abdel-Mogib *et al.,* 2000). Elshamy *et al.* (2020) reported 70 metabolites belonging to phenolic acids, organic acids, cinnamic acid derivatives, flavonoids, stilbenes, aurones, quinones, terpenes and steroids from *Cyperus conglomerates* through UPLC-qTOF-MS/MS analysis. The fatty acid profile of the tubers comprised of mainly stearic acid, myristic acid, palmitolic acid and behenoic acid (Ghaferah *et al.*, 2018).

Cyperus distans: The plant, an annual herb, is native to tropical and subtropical wetlands. The phytochemical study of *Cyperus distans* revealed the presence of scabequinone with antifeeding effects (Morimoto *et al.,* 1999). Zierone has been identified as the major component of the rhizome essential oil (**Figure 11)** (Lawal and Oyedeji, 2009).

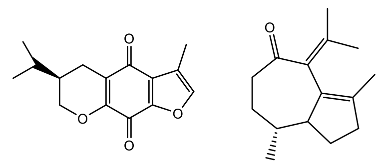
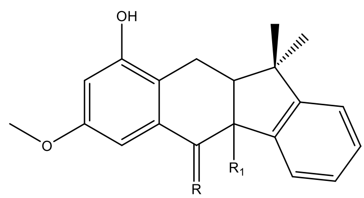


Figure 11. The quinone scabequinone and the sesquiterpenoid zierone reported from *Cyperus distans*

Phytochemical studies on *Carex* species: *Carex* L. with more than 2000 species is the largest genus of the family Cyperaceae, and also one of the largest vascular plant groups. They occur in very differentiated habitats, both in wet and moist localities and also in extremely dry habitats. The genus *Carex* has attracted the attention of phytochemists, especially due to the characteristic phenolic constituents. Literature review revealed that 53*Carex*species have been investigated for their phytochemicals (**Table 1**). Among various *Carex* species, the widely investigated species is *Carex distachya*.

Harborne (1971) had performed two-dimensional chromatographic investigation on the distribution of kaempferol, quercetin, glycoflavone, luteolin and tricin in leaf extracts of different *Carex* species. Bogucka-kocka *et al*. (2011) estimated the phenolic acids (caffeic, ferulic, p-coumaric, p-hydroxybenzoic, protocatechuic, sinapic, syringic and vanillic acid) in the aerial parts of 18 *Carex* species from Central Europe. Several new lignan glycosides and furofuran type lignan aglycones were reported from the polar extract of *Carex distachya* (Fiorentino *et al*., 2008). Ricci *et al*. (2008) investigated in detail the fragmentation pattern of the complex lignans by tandem mass spectrometry. Novel class of dibenzoxazepinones were also reported from the species (Fiorentino *et al*., 2007). Stilbenoid derivatives are another characteristic class of phenolics identified from several *Carex* species. Oligostilbenes formed by 2-4 monomers of resveratrol and tetracyclic prenylated stilbenes are characteristic of the genus (D'Abrosca *et al.*, 2005). The stilbenoidscaraxanes with unusual tetracyclic structure with a hydroxyl group at the C-3 carbon and a methoxyl group at the C-5 were reported from *Carex distachya* (**Figure 12)**.



1	R= βOH, αH	R1= βH
2	R= O	R1= αOH
3	R= O	R1= βOH

Figure 12. Caraxanes A-C (1. Caraxane A, 2. Caraxane B and 3. Caraxane C)

Phytochemical studies on *Kyllinga* species: *Kyllinga,* frequently referred to as spike sedges, is another widely distributed genus in the Cyperaceae family. Alkaloids, coumarins, flavonoids, glycosides, lignins, phenols, steroids, tannins and terpenoids were reported from the genus (Verma *et al.,* 2017). The essential oil of fragrant kyllinga, *Kyllinga odorata* Vahl showed dihydrokaranone and aristolochene as the major compounds (Tucker *et al.*, 2006). Literature review revealed that 8 *Kyllinga* species have been investigated for their phytochemicals.

Phytochemical studies on *Rhynchospora* species: Though the genus *Rhynchospora* Vahl. is widely distributed globally, with about 270 species, it is least investigated for the phytochemicals, except for *Rhynchospora corymbosa* (Strong, 2006; Annie *et al*., 2016; Bezerra *et al*., 2019).

Phytochemical studies on *Scleria* species: The genus *Scleria*, commonly known as nutrush, consists of perennial herbs. *Scleria* has not attracted much attention from phytochemists, except for a few reports on essential oils. *Scleria striatonux* rhizome is used in some parts of Cameroon as a spice and possessed a very pronounced inhibitory activity. The rhizomes afforded novel bicyclic cyclofarnesyl endoperoxide class of sesquiterpenoids; okundoperoxide, sclerienone A-C (Kennedy *et al.*, 2016).

Phytoremediation potential of Cyperaceae species

Hyperaccumulators can tolerate, take up and translocate high levels of certain metals that would be toxic to most organisms. Many of the Cyperaceae members have heavy metal phytoremediation potential from contaminated water sources and can be considered as hyperaccumulators. The sedge plant *Cyperus alopecuroides* was found as a powerful phytoremediator to remove heavy metals from contaminated water bodies. *Cyperus alopecuroides* roots accumulated concentrations of all measured heavy metals, except Ni, Cu, Zn, and Pb, more significant than the shoot. The bioconcentration factor was generally > 1, while the translocation factor of all elements, except Pb, was < 1 (Galal *et al.*, 2021). It has been demonstrated that *Cyperus laxus* significantly reduces the hydrocarbon levels from soils containing up to 325,000 mg THC Kg^{-1} soil (Casado *et al.*, 2015). *Cyperus alternifolius* and *Cyperus dives* were found as effective phytostabilizers of Arsenic, Cadmium and Lead metals with greater than one biocentration factor values, while translocation factor values were less than one. *Cyperus alternifolius* also reduced significantly the total nitrogen content of the influent water in a vertical-flow constructed wetland model (Cui *et al.*, 2009). The plant was also efficient in removing phenolic compounds up to 98.8% from waste water. The plants accumulated trace elements, especially in the roots, with the order of Fe > Mn > Cu > Zn > B > Pb > Cr > Ni > Co > Cd (Goren *et al.*, 2021).*Cyperus rotundus* and *Cyperus alternifolius* were found to eliminate fluoride from water (Neetin Desai, 2020).

Evaluation of the phytoremediation potentiality of *Cyperus articulatus* revealed maximum accumulation for iron (105.5 and 900 µg/g dry wt.) in wastewater, while minimum values were obtained for the accumulation of cadmium (0.9 to 1.95 µg/g d.wt.), among the tested metals As, Cd, Cr, Cu, Fe, Hg, Mn, Ni and Pb (Farrag and Fawzy, 2012). *Cyperus articulatus* plants accumulated most of the heavy metals, except Pb, in their roots than in the shoots, and the bioaccumulation factor was > 1, and the translocation factor of most heavy metals, except Pb was <1 (Galal *et al.*, 2017).

Antifeedant, insecticidal and repellent phytochemicals in Cyperaceae species

Cyperaceae are generally not affected by pests in upland and paddy fields, and are seldom damaged by phytophagous insects, because they contain insect antifeedants. Morimoto *et* *al*., (1999) observed the insect repellent property of many of the *Cyperus* species and showed that the hexane extract of *C. amuricus, C. brevifolius, C. ceperinus, C. cyperoides, C. difformis, C. diffuse, C. distans, C. flavidus, C. haspan, C. iria, C. javanicus, C. microiria, C. monophyllus, C. nipponicus, C. nutans, C. odoratus, C. orthostachyus, C. pilosus, C. sanguinolentus, C. serotinus* and *C. stoloniferous* were strongly insect repellent. From the basal stem of *Cyperus nipponicus* and *Cyperus distans* the antifeedants remirol, cyperaquinone and scabequinone were identified (**Figure 13)** (Morimoto *et al*., 1999). Hexane extract of *Cyperus compresses* also possess strong insect repellent property (Al-Shamma *et al*., 1979). Hexane extract of *Cyperus rotundus* rhizomes was found to be effective against the mosquitos *Anopheles culicifacies*, *Anopheles stephensi* and *Culex quinquefasciatus*. *Cyperus rotundus* was found as more effective insecticidal than carbamate and has almost the same efficacy as that of organophosphate (Bañez and Castor, 2011). Essential oil of *Cyperus rotundus* rhizomes showed remarkable activities on eggs and instar larvae of *Aedes albopictus* (Imam and Chandra, 2014). The sesquiterpene ketone, α-cyperone, a constituent of several Cyperaceae members showed significant insecticidal activity against diamond back moth (DBM) larvae (Dadang *et al.*,1996).

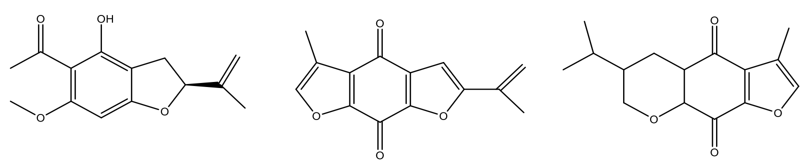


Figure 13. The antifeedants isolated from Cyperaceae plants. **A-** Remirol, **B-** Cyperaquinone and **C-** Scabequinone

Allelochemicals in Cyperaceae species

Plants produce a wide variety of allelochemicals to protect themselves from pathogens, herbivores and from neighbouring plants. Allelochemicals are particularly significant in inhibiting the growth of neighbouring plants. The organic solvent extracts, essential oils and isolated compounds from various Cyperaceae members showed allelopathic properties, and several natural products, *viz*., coumarins, quinones and sesquiterpenes have been identified as potential allelochemicals (Dini *et al*., 1992; Dini *et al*., 1993). Morimoto and Komai (2005) reported that the sesquiterpenoids cyperotundone and α-cyperone produced in *Cyperus rotundus* can inhibit the growth of other plants nearby (**Figure 14)**. Stilbenoids and flavonoids from *Carex distachya* have been shown to act as allelochemicals in the Mediterranean macchia vegetation (Fiorentino *et al*., 2008).

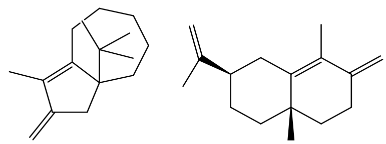


Figure 14. Allelochemicals in *Cyperus rotundus,* cyperotundone and α-cyperone

Chemotaxonomic evaluation

Plant chemosystematics is the application of chemical data to systematic problems, and explored for explaining relationships between plants and inferring phylogeny (Singh, 2016). Among secondary metabolites, flavonoids with wide structural features are more useful for studying relationships within the species and genus level (Harborne, 1994). Generally, the angiosperm flavonoid evolution involves a progressive reduction in the number of different flavonoid structural classes; the reduction of a flavonol-glycoflavone profile to glycoflavones alone is often used as an example.

Most of the systematic classifications of Cyperaceae are based on the classical taxonomic features, obtained as a result of morphological and anatomical analyses. However, the diversity of flavonoids, oligostilbenes, phenolic acids and fatty acids are described as useful chemotaxonomic markers for Cyperaceae. Flavonoids are common phytochemicals in Cyperaceae. Earlier studies on the flavonoid chemistry included generalized acid-hydrolysis surveys of the Cyperaceae, that suggested possible putative relationships between the Cyperaceae, Gramineae and Juncaceae, but yielded little information below the generic level. Harborne *et al* have extensively studied the distribution pattern of flavonoids in around 100 Cyperaceae plants in Australia and arrived at significant correlations (Clifford and Harborne, 1969; Harborne, 1971; Harborne *et al.*, 1985).

Flavones, such as tricin and luteolin are very common in Cyperaceae species. Luteolin 5-methyl ether was found in several Cyperaceae genera, while luteolin 7-methyl ether, diosmetin and acacetin were limited in the Cyperaceae. Flavonols and their methyl ethers were detected in over one-third of the species, particularly in the leaves of the genera *Fuirena, Gahnia, Lepidosperma* and *Mesomelaena*. Myricetin was found only in two *Baumea* species. The 3-desoxyanthocyanidin carexidin was found in the inflorescences of eight Cyperaceae species (Harborne *et al.*, 1985). The presence of the characteristic leaf flavonoids (glycoflavones, tricin) of the grasses showed that the Cyperaceae and the Gramineae are more closely linked chemically than a previous study of their inflorescence pigments suggested (Harborne, 1971). Aurone pigments, the most distinctive Cyperaceae family constituents, were found in the leaves of 25% of the species and in the inflorescences of 40% species. The absence or presence and type of quinonoid constituents in the roots and rhizomes of the genus *Cyperus* have proved consistent with the accepted divisions within this genus (Allan *et al.*, 1978). The abundant aglycones of the inflorescence spike of Fraser's sedge (*Cymophyllus fraseri*) indicate a biochemical feature differentiating leaf and floral tissues. This is contrary to the general concept that high concentrations of water-soluble glycosides are expected in flower tissues (Robert and James, 1988). Among the five *Scirpus* species; *S. holoschenus, S. lacustris, S. littoralis, S. maritimus* and *S. multicaule* collected from Iran, all the taxa contain flavonoid sulphates, flavone C and C-/O-glycosides and aglycones, while *Scirpus maritimus* was distinct by the distribution of flavonoid aglycones (Noori *et al.*, 2012). Bogucka-Kocka *et al.* (2011) used phenolic acids from the aerial parts of *Carex* species as chemotaxonomic markers for delimitation of the species. However, several attempted tests of aggregative cluster analysis showed no similarity to the real taxonomical structure of the genus *Carex* with the phenolic acid distribution. There is scope for further investigation using modern analytical techniques such as LC-MS/MS, ambient analytical techniques and head space analytical techniques for the rapid comparison of various taxa among the Cyperaceae family.

Conclusions

The Cyperaceae family is the 10th largest flowering plant families and is ranked the third largest monocot family after Orchidaceae and Poaceae. Across the diverse traditional systems of medicine, plants coming under the Cyperaceae family are popularly employed as potent ethnomedicines owing to the plethora of pharmacological attributes and the presence of diverse phytochemicals. The highly potential trans-stilbene resveratrol and its derivatives are reported from several Cyperaceae members. However, though nearly 5,500 species are reported in the family, literature review revealed only 180 species have been investigated phytochemically, and majority are studied for the volatile chemicals or distribution of flavonoids only. There is scope for detailed phytochemical studies involving solvent extraction, separation through various chromatographic techniques, and characterisation using different spectroscopic techniques, and also through modern hyphenated techniques such as LC-MS/MS and LC-NMR.

References

1. Abdel- Mojib M, Basaif SA and Sobhi TR. **2001**. Stilbenes and a new acetophenone derivative from *Scirpus holoschoenus*. *Molecules*, 6, 663-667.
2. Abdel- Mogib M, Basaif SA and Ezmirly ST. **2000**. Two novel flavans from *Cyperus conglomeratus*. *Pharmazie*, 55(9), 693-695.
3. Abdel-Mogib M and Serag MS. **2001**. Prenylflavanone from *C. capitatus* Alex. *J. Pharm. Sci*., 15(2), 129-131.
4. Abdel-Razik AF, Nassar MI, El-khrisy EDA, Dawidar AAM and Mabry TJ. **2005**. New prenylflavans from *Cyperus conglomeratus*. *Fitoterapia*, 76(7-8), 762-764.
5. Abdou Bouba A, Ponka R, Augustin G, NjintangYanou N, Abul-Hamd El-Sayed M, Montet D and Mbofung CM. **2016**. Amino acid and fatty acid profile of twenty wild plants used as spices in Cameroon. *Am. J. Food Technol*., 2(4), 29-37.
6. Abhijeet VP. **2022**. A concise review on ethnobotany, phytochemistry and pharmacology of plant *Kyllinga triceps* Rottb. *Auct*., 5(2), 1-6.
7. Abu-Mellal A, Koolaji N, Duke RK, Tran VH and Duke CC. **2012**. Prenylated cinnamate and stilbenes from Kangaroo Island propolis and their antioxidant activity. *Phytochemistry*, 77, 251-259.
8. Adejuyitan JA. **2011**. Tiger nut processing: Its food uses and health benefits. *Am. J. Food Tech*., 6(3), 197-201.
9. Ahmed AH. **2012**. Chemical and biological studies of *Cyperus alternifolius* flowers essential oil. *Asian J. Chem*., 24(10), 4768-4770.
10. Ahmad SZ, Khan Z and Mirza SA. **2022**. Assessment of ethnopharmacological potential of *Cyperus difformis* L. in terms of its phytochemistry, antibacterial, antioxidant and anticancer attributes. *Notulae Botanicae Horti. Agrobotanic. Cluj-Napoca.*, 50(4), 12918-12919.
11. Ahmed AZ, Samir AR, Yasser AE and Ikhlas AK. **2018**. New flavans and stilbenes from *Cyperus conglomeratus.Phytochem. Lett*., 26, 159-163.
12. Allan RD, Correll RL and Wells RJ. **1969**. A new class of quinones from certain members of the family Cyperaceae. *Tetrahedron Lett*., 53, 4669-4672.
13. Allan RD, Dunlop RW, Kendall MJ, Wells RJ and MacLeod JK. **1973**. C_{15} Quinones from *Cyperus* species. *Tetrahedron Lett*., 14(1), 3-5.

14. Allan RD, Wells RJ, Correll RL and MacLeod JK. **1978**. The presence of quinones in the genus *Cyperus* as an aid to classification. *Phytochemistry*, 17(2), 263-266.
15. Al-Rowaily SL, Abd-ElGawad AM, Alghanem SM, Al-Taisan WA and El-Amier YA. **2019**. Nutritional value, mineral composition, secondary metabolites, and antioxidant activity of some wild geophyte sedges and grasses. *Plants (Basel)*, 8(12), 569.
16. Alves AC, Moreira MM, Pacl MI and Costa MAC. **1992**. A series of eleven dialkyl-hydroxy-p-benzoquinones from *Cyperus capitatus. Phytochemistry,* 31(8), 2825-2827.
17. Angel A, Eleuterio B, Pedro JN, Angel GR and Ana EB. **2011**. Benzodihydrofurans from *Cyperus teneriffae*. *J. Nat. Prod.*, 74(5), 1061-1065.
18. Annie LNP, Jean-de-Dieu T, Mehreen L, Léon AT, Jules-Roger K, David N and Muhammad SA. **2016**. New triterpene and new flavone glucoside from *Rhynchospora corymbosa* (Cyperaceae) with their antimicrobial, tyrosinase and butyrylcholinesterase inhibitory activities. *Phytochemistry Lett*., 16, 121-128.
19. Apers S, Huang Y, Miert SV, Dommisse R, Berghe DV, Pieters L and Vlietinck A. **2002**. Characterisation of new oligoglycosidic compounds in two Chinese medicinal herbs. *Phytochem. Anal.*, 13(4), 202-206.
20. Arraki K, Richard T, Badoc A, Pédrot E, Bisson J, Waffo-Téguo P, Mahjoub A, Mérillon JM and Decendit A. **2013**. Isolation, characterization and quantification of stilbenes from some *Carex* species. *Rec. Nat. Prod.*, 7, 281-291.
21. Arraki K, Totoson P, Decendit A, Badoc A, Zedet A, Jolibois J, Pudlo M, Demougeot C and Girard-Thernier C. **2017**. Cyperaceae species are potential sources of natural mammalian arginase inhibitors with positive effects on vascular function. *J. Nat. Prod.*, 80, 2432-2438.
22. Awaad AS and Zain ME. **1999**. *Cyperus alopecuroides* coumarins and antimicrobial activity. *Egypt. J. Pharm.Sci.*, 40(2), 107-116.
23. Bakaly K, Lassine S and Claud CJ .**2001**. A Review: Compounds isolated from *Cyperus* species (Part II): Terpenoidal. *Int. J. Pharmacogn. Phytochem. Res*., 7(12), 96-99.
24. Bañez SES and Castor L.**2011**. Phytochemical and pesticidal properties of barsanga (*Cyperus rotundus* Linn.). *JPAIR Multidisc. J*., 6(1), 197-214.
25. Basaif SA. **2003**. Stilbenes from *Cyperus conglomeratus. J. Saudi. Chem. Soc*., 7(2), 259-262.
26. Bendimerad N and Taleb SA. **2005**. Composition and antibacterial activity of *Pseudocytisus integrifolius* (Salisb.) essential oil from Algeria. *J. Agric. Food Chem.*, 53, 2947-2952.
27. Bezerra JJL, do Nascimento TG, Kamiya RU, do Nascimento Prata AP, de Medeiros PM and de MendonÃ CN. **2019**. Phytochemical screening, chromatographic profile

and evaluation of antimicrobial and antioxidant activities of three species of the Cyperaceae Juss. Family.*J. Med. Plants Res.*, 13(14), 312-320.

28. Bhatt SK, Saxena VK and Singh KV. **1981**. A leptosidin glycoside from leaves of *Cyperus scariosus*. *Phytochemistry,* 20(11), 2605.
29. Bhawna K, Satis S, Lalit S, Sharmistha M and Tanuja S. **2013**. *Cyperus scariosus*: A potential medicinal herb. *Int. Res. J. Pharm*., 4, 17-20.
30. Bogucka-Kocka A and Janyszek M. **2010**. Fatty acids composition of fruits of selected Central European sedges (*Carex* L. Cyperaceae). *Grasas y Aceites*, 61(2), 165-170.
31. Bogucka-Kocka A, Szewczyk K, Janyszek M, Janyszek S and Ciesla L. **2011**. RP-HPLC analysis of phenolic acids of selected Central European *Carex* L. (Cyperaceae) species and its implication for taxonomy. *J. AOAC. Intl.*, 94(1), 9-16.
32. Bordoloi M, Shukla VS, Nath SC and Sharma RP. **1998**. Naturally occurring cadinenes. *Phytochemistry,* 28(8), 2007-2037.
33. Boyom FF, Ngouana N, Amvam PH, Menut C, Bessiere JM, Gut J and Rosenthal PJ. **2003**. Composition and anti-plasmodial activities of essential oils from some Cameroonian medicinal plants. *Phytochemistry*, 64, 1269-1279.
34. Brillatz T, Jacmin M, Queiroz EF, Marcourt L, Slacanin I, Petit C and Wolfender JL. **2020**. Zebrafish bioassay-guided isolation of antiseizure compounds from the Cameroonian medicinal plant *Cyperus articulatus* L. *Phytomedicine*, 70, 153175.
35. Buommino ED, Abrosca B, Donnarumma G, Parisi A, Scognamiglio M, Fiorentino A and De Luca A. **2017**. Evaluation of the antioxidant properties of carexanes in AGS cells transfected with the *Helicobacter pylori's* protein HspB. *Microb. Pathog.*, 108, 71-77.
36. Cantalejo MJ. **1997**. Analysis of volatile components derived from raw and roasted earth-almond (*Cyperus esculentus* L.). *J. Agric. Food Chem*., 45, 1853-1860.
37. Carlos JP, Marina R, Alfonso J and María CG. **2022**. Chemical composition and bioactive antioxidants obtained by microwave-assisted extraction of *Cyperus esculentus* L. by-products: A valorizationapproach. *Front. Nutr*., 9, 944830.
38. Casado NAR, Montes HMDC, Rodríguez V R, Esparza GFJ, Pérez VJ, Ariza CA and Calva CG. **2015**. The fatty acid profile analysis of *Cyperus laxus* used for phytoremediation of soils from aged oil spill-impacted sites revealed that this is a C18: 3 plant species. *PLoS One*, 10(10), e0140103.
39. Chatterjee A, Khanra R, Chattopadhyay M, Ghosh S, Sahu R, Nandi G, Maji HS and Chakraborty P. **2022**. Pharmacological studies of rhizomes of extract of *Cyperus tegetum,* emphasized on anticancer, anti-inflammatory and analgesic activity. *J Ethnopharmacol.*, 10,289,115035.
40. Chau NM, Hanh TTH, Luyen NT, Van Minh C and Dat NT. **2013**. Flavanones and stilbenes from *Cyperus stoloniferus* Retz. *Biochem. Syst. Ecol*., 50, 220-222.

41. Cho HS, Lee JH, Ryu SY, Joo SW, Cho MH and Lee J. **2013**. Inhibition of *Pseudomonas aeruginosa* and *Escherichia coli* O157:H7 biofilm formation by plant metabolite ε-viniferin. *J. Agric. Food Chem*., 61, 7120-7126.
42. Chowdhury JU, Yusuf M and Hossain MM. **2005**. Aromatic plants of Bangladesh: Chemical constituents of rhizome oil of *Cyperus scariosus* R. Br. *Ind. Perf.,* 49,103-105.
43. Clemente-Villalba J, Cano-Lamadrid M, Issa-Issa H, Hurtado P, Hernández F, Carbonell-Barrachina ÁA and López-Lluch D. **2021**. Comparison on sensory profile, volatile composition and consumer's acceptance for PDO or non-PDO tigernut (*Cyperus esculentus* L.) milk. *Lwt*, 140, 110606.
44. Clery RA, Julie RLC and Veronika. **2016**. Constituents of Cyprioloil (*Cyperus scariosus* R.Br.): N-containing molecules and key aroma components. *J. Agric. Food Chem*., 64, 229, 4566-4573.
45. Clifford HT and Harborne JB. **1969**. Flavonoid pigmentation in the sedges (Cyperaceae). *Phytochemistry*, 8(1), 123-126.
46. Coşkuner Y, Ercan R, Karababa E and Nazlıcan AN. **2002**. Physical and chemical properties of chufa (*Cyperus esculentus* L) tubers grown in the Çukurova region of Turkey. *J. Sci. Food Agric*., 82(6), 625-631.
47. Cui LH, Ouyang Y, Chen Y, Zhu XZ and Zhu WL. **2009**. Removal of total nitrogen by *Cyperus alternifolius* from wastewaters in simulated vertical-flow constructed wetlands. *Ecol. Eng*., 35(8), 1271-1274.
48. D'Abrosca B, Fiorentino A, Golino A, Monaco P, Oriano P and Pacifico S. **2005**. Carexanes: Prenylstilbenoid derivatives from *Carex distachya*. *Tetrahedron Lett*., 46(32), 5269-5272.
49. Dadang, Ohsawa N, Kato S and Yamamoto I. **1996**. Insecticidal compound in tuber of *Cyperus rotundus* L. against the diamond back moth larvae. *J. Pest. Sci*., 21, 444-446.
50. Datta S, Seal T, Sinha BK and Bhattacharjee. **2018**. RP-HPLC based evidences of rich sourced of phenolics and water-soluble vitamins in an annual sedge *Cyperus compressus*. *J. Phy. Pharm.,* 7(3), 305-311.
51. Dávid CZ, Hohmann J and Vasas A. **2021**. Chemistry and pharmacology of Cyperaceae stilbenoids: A review. *Molecules,* 26(9), 2794-2796.
52. Dávid ZC, Kúsz N, Bakacsy L, Hohmann J and Vasas A. **2021.** Phytochemical investigation of *Carex praecox*. doi: 10.14232/ syrpharmacognosy.2021.a5
53. Diaz MCR, Caravaca AG, Hernandez EJG, Villanova BG and Verardo V. **2022**. New advances in the phenolic composition of Tiger Nut (*Cyperus esculentus* L.) by products. *Foods*, 11(3), 343-347.
54. Dini A, Ramundo E, Saturnino P, Scimone A and D'Alcontres IS. **1993**. Coumarins in *Cyperus incompletus*. *Biochem. Syst. Ecol*., 21(2), 305-312.

55. Dini A, Ramundo E, Saturnino P, Scimone A and d'Alcontres S. **1992**. Isolation, characterization and antimicrobial activity of coumarin derivatives from *Cyperus incompletus*. *Boll. Soc. Ital. Biol.*, 68(7), 453-461.
56. Djomdi D, Kramer JKG, Vander Jagt DJ, Ejoh R, Ndjouenkeu R and Glew RH. **2013**. Influence of soaking on biochemical components of tigernut (*Cyperus esculentus*) tubers cultivated in Cameroon. *Int. J. Food Process Eng.*, 1(1), 1-15.
57. Dolmazon R, Albrand M, Bessiere JM, Mahmout Y, Wernerowska D and Lolodziejczyk K. **1995**. Diterpenoids from *Kyllinga erecta*. *Phytochemistry,* 38(4), 917-919.
58. Dolmazon R, Fruchier A, and Kolodziejczyk K. **1995**. An epi-13-manoyloxide diterpenoid from *Kyllinga erecta*. *Phytochemistry*, 40 (5), 1753-1754.
59. Dolmazon R, Mahmout Y and Bessiere JM. **2001**. A new diterpenoid from *Kyllinga erecta*. *Flavour Fragr. J.*, 16(2) 100-102.
60. Dubey N, Gupta RL and Raghav CS. **2011**. Study of yield, quality and fungicidal properties of *Nagarmotha* oil. *Pest. Res. J.*, 23(2), 185-189.
61. Duke CC, Tran VH, Duke RK, Abu-Mellal A, Plunkett GT, King DI, Hamid K, Wilson KL, Barrett RL and Bruhl JJ. **2017**. A sedge plant as the source of Kangaroo Island propolis rich in prenylated p-coumarate ester and stilbenes. *Phytochemistry,* 134, 87-97.
62. Ekundayo O, Oderinde R, Ogundeyin M and Stahl Biskup E. **1991**. Essential oil constituents of *Cyperus tuberosus* Rottb. rhizomes. *Flavour Fragr. J.*, 6, 261-264.
63. El Gendy AEN, Abd El-Gawad AM, Taher RF, El-Khrisy, Omer E and Elshamy AI. **2017**. Essential oils constituents of aerial parts of *Cyperus capitatus* L. and *Cyperus difformis* L. grown wild in Egypt. *J. Essent. Oil-Bear. Plants*, 20, 1659-1665.
64. El-Gohary H. **2004.** Study of essential oil of the tubers of *Cyperus rotundus* L. and *Cyperus alopecuroides* Rottb. *Bull. Fac. Pharm. Cairo Univ.*, 42(1), 161- 164.
65. El-Habashy I, Mansour RMA, Zahran MA, El-Hadidi and Saleh NAM. **1989**. Leaf flavonoids of *Cyperus* species in Egypt. *Biochem. Sys. Ecol.*, 17(3), 191-195.
66. Elshamy AI, Farrag ARH, Ayoub IM, Mahdy KA, Taher RF, Gendy AE-NGE, Mohamed TA, Al-Rejaie SS, EI-Amier YA, Abd-EIGawad AM and Farag MA. **2020**. UPLC-qTOF-MS phytochemical profile and antiulcer potential of *Cyperus conglomerates* Rottb. alcoholic extract. *Molecules*, 25(18), 4234-4236.
67. Elshrif SS, El GendyAENG, Elshamy AI, Nassar MIand El-SeediHR. **2017**. Chemical composition and TLC-DPPH-radical scavenging activity of *Cyperus alternifolius* Rottb. essential oils. *J. Essent. Oil-Bear. Plants*, 20(4), 1125-1130.
68. Erdem B, Bagci E, Dogan G, Aktoklu E and Dayangac A. **2018**. Chemical composition and antimicrobial activities of essential oil and ethanol extract of *Cyperus fuscus* L burs from Turkey. *Trop. J. Pharm.*, 17(8), 1637-1643.
69. Farrag H and Fawzy M. **2012**. Phytoremediation potentiality of *Cyperus articulatus* L. *Life Sci*., 9(4), 4032-4040.

70. Feizbakhsh A, Aghassi A and Naeemy A. **2012**. Chemical constituents of the essential oils of *Cyperus difformis* L. and *Cyperus arenarius* Retz from Iran. *J. Essent. Oil-Bear. Plants,* 1 (15), 48-52.
71. Fiorentino A, D'Abrosca B, Pacifico S, Cefarelli G, Uzzo P, Letizia M and Monaco P. **2007**. Natural dibenzoxazepinones from leaves of *Carex distachya*: structural elucidation and radical scavenging activity. *Bioorg. Med. Chem.*, 17, 636-639.
72. Fiorentino A, D'Abrosca B, Pacifico S, Cefarelli G, Uzzo P, Letizia M and Monaco P. **2007**. Natural feruloyl monoglyceride macrocycles as protecting factors against free-radical damage of lipidic membranes. *Bioorg. Med. Chem.*, 17, 4135-4139.
73. Fiorentino A, D'Abrosca B, Pacifico S, Iacovino R, Izzo A, Uzzo P, Russo A, Di Blasio B and Monaco P. **2008**. Carexanes from *Carex distachya* Desf.: Revised stereochemistry and characterization of four novel polyhydroxylated prenylstilbenes. *Tetrahedron*, 64, 7782-7786.
74. Fiorentino A, D'Abrosca B, Pacifico S, Izzo A, Letizia M, Esposito A and Monaco P. **2008**. Potential allelopathic effects of stilbenoids and flavonoids from leaves of *Carex distachya* Desf. *Biochem. Syst. Ecol.*, 36, 691-698.
75. Fiorentino A, D'Abrosca B, Pacifico S, Natale A and Monaco P. **2006**. Structures of bioactive carexanes from the roots of *Carex distachya* Desf. *Phytochemistry*, 67, 971-977.
76. Fiorentino A, Ricci A, D'Abrosca B, Pacifico S, Golino A, Letizia M, Piccolella S and Monaco P. **2008**. Potential food additives from *Carex distachya* roots: Identification and *in vitro* antioxidant properties. *J. Agric. Food Chem.*, 56, 8218-8225.
77. Fiorentino A, D'Abrosca, B, Pacifico S, Izzo A, D'Angelo G and Monaco P. **2010**. Bioactive clerodane diterpenes from roots of *Carex distachya*. *Nat. Prod. Commun.*, 5(10), 1539-1542.
78. Fraternale D, Giamperi L, Bucchini A and Ricci D. **2007**. Essential oil composition and antioxidant activity of aerial parts of *Grindelia robusta* from Central Italy, *Fitoterapia*, 78, 443-335.
79. Galal TM, Gharib FA, Ghazi SM and Mansour KH. **2017**. Metal uptake capability of *Cyperus articulatus* L. and its role in mitigating heavy metals from contaminated wetlands. *Environ. Sci. Pollut. Res. Int.*, 24(27), 21636-21648.
80. Galal TM, Shedeed ZA, Gharib FA, Al-Yasi HM and Mansour KH. **2021**. The role of *Cyperus alopecuroides* Rottb. sedge in monitoring water pollution in contaminated wetlands in Egypt: a phytoremediation approach. *Environ. Sci. Pollut. Res. Int.*, 28(18), 23005-23016.
81. Gamal AM. **2015**. Iridoids and other constituents from *Cyperus rotundus* L. rhizomes. *Bull. Fac. Pharm. Cairo Univ.*, 53(1), 5-9.

82. Gamal MA, Elhady SS and Ibrahim RMS. **2015**. A Review: Compounds Isolated from *Cyperus* species (PartI): Phenolics and nitrogenous. *Int. J. Pharmacog. Phytochem. Res*., 7(1), 51-67.
83. Garg N, Misra LN, Siddique MS and Agarwal SK. **1990**. Volatile constituents of the essential oil of *Cyperus scariosus* tubers. In: Bhattacharyya S C, Sen N and Sethi K L (eds.) Proc International congress of essential oils, *Flavour Fragr. J.*, 161-65.
84. Ghaferah HAH, Amani SA, Monerah RA, and Saleh IA. **2018**. Anticandidal activity of the extract and compounds isolated from *Cyperus conglomertus* Rottb, *Saudi Pharm. J.*, 26(6), 891-895.
85. Gil MI, Tomás-Barberán FA, Hess-Pierce B, Holcroft DM and Kader AA. **2000**. Antioxidant activity of pomegranate juice and its relationship with phenolic composition and processing. *J. Agric. Food Chem.*, 48(10), 4581-4589.
86. Giri BR and Roy B. **2015**. Resveratrol and α-viniferin-induced alterations of acetylcholinesterase and nitric oxide synthase in *Raillietina echinobothrida*. *Parasitol. Res.*, 114, 3775-3781.
87. Giri BR, Bharti RR and Roy B. **2015**. *In vivo* anthelmintic activity of *Carexbaccans* and its active principal resveratrol against *Hymenolepis diminuta.Parasitol. Res.,* 114(2), 785-788.
88. Gohary HMA. **2004**. Study of essential oils of the tubers of *Cyperus rotundus* L. and *Cyperus alopecuroides* Rottb. *Int. J. Pharmacog. Phytochem. Res.*, 12, 45-49.
89. Gonzalez Sarrias A, Gromek S, Niesen D, Seeram MP and Henry GE. **2011**. Resveratrol oligomers isolated from *Carex* species inhibit growth of human colon tumorigenic cells mediated by cell cycle arrest. *J. Agric. Food Chem.*, 59(16), 8632-8638.
90. Goren AY, Yucel A, Sofuoglu SC and Sofuoglu A. **2021**. Phytoremediation of olive mill wastewater with *Vetiveria zizanioides* (L.) Nash and *Cyperus alternifolius* L. *Environ. Technol. Innov.*, 24, 102071.
91. Gugsa T and Yaya EE. **2018**. Chemical constituents of the traditional skin care and fragrance nut, *Cyperus esculentus* (tigernut). *Am. J. Essent. Oil Nat. Prod.*, 6, 4-12.
92. Guilhon GM, Vilhena KDS, Zoghbi MDG, Bastos MDN and da Rocha AE. **2008**. Volatiles from aerial parts and rhizomes of *Kyllinga brevifolia* Rottb. growing in Amazon. *J. Essen. Oil Res.*, 20(6), 545-548.
93. Ha JH, Lee KY, Choi HC, Cho J, Kang BS, Lim JC and Lee DU. **2022**. Modulation of radioligand binding to the GABA (A)-benzodiazepine receptor complex by a new component from *Cyperus rotundus. Biol. Pharm. Bull*., 25(1), 128-130.
94. Harborne JB and Baxter H. **1993**. Phytochemical Dictionary, Taylor and Francis Ltd., London, 362.
95. Harborne JB, Williams CA and Wilson KL. **1982**. Flavonoids in leaves and inflorescences of Australian *Cyperus* species. *Phytochemistry*, 21(10), 2491-2507.

96. Harborne JB, Williams CA and Wilson KL. **1985**. Flavonoids in leaves and inflorescences of Australian Cyperaceae. *Phytochemistry*, 24(4), 751-766.
97. Harborne JB. **1971**. Distribution and taxonomic significance of flavonoids in the leaves of the Cyperaceae. *Phytochemistry,* 10, 1569-1574.
98. Heba D, Hassanein Naglaa MN, Naglaa M, Abdelaaty AS, Hammouda, Faiza MH, Sayed AA and Mahmoud AS. **2014**. Chemical diversity of essential oil from *Cyperus articulates, Cyperus esculentus* and *Cyperus papyrus. J. Essent. Oil-Bear. Plants,* 17(2), 251- 264.
99. Hikino H, Aota K and Takemoto T. 1965. Structure of cyperotundone. *Chem. Phar. Bull.,* 13(5), 628-630.
100. Hikino H and Aota K. **1976**. 4α,5α-Oxidoeudesm-11-en-3α-ol, sesquiterpenoid of *Cyperus rotundus. Phytochemistry,* 16, 1265-1266.
101. Hikino H, Aota K and Takemoto T. 1965. Structure of cyperotundone. *Chem. Pharmaceut. Bul*., 13(5), 628-630.
102. Hisham A, Rameshkumar KB, Sherwani N, Al-Saidi S and Al-Kindy S. **2012**. The composition and antimicrobial activities of *Cyperus conglomeratus*, *Desmos chinensis* var. *lawii* and *Cyathocalyx zeylanicus* essential oils. *Nat Prod Commun*., 7(5), 663-666.
103. Iriny MA, Bast MA, Elghonemy MM, Bashandy SA, Ibrahim FAA, Farid OAH, Gendy AG, Afifi SM, Tuba E, Farrag ARH, Farag MA and Elshamy A. **2022**. Chemical profile of *Cyperus laevigatus* and its protective effects against Thioacetamide -Induced hepatorenal toxicity in rats. *Molecules,* 27, 6470-6472.
104. Ito T, Endo H, Shinohara H, Oyama M, Akao Y and Iinuma M. **2012**. Occurrence of stilbene oligomers in *Cyperus* rhizomes. *Fitoterapia*, 83, 1420-1429.
105. Iwamura J, Komaki K, Komai K and Hirao N. **1978**. The constituents of essential oil from *Cyperus iria* L. *J. Agri. Chem. Soc. Jap*., 52, 379- 383.
106. Iwamura JI. **1979.** The constituents of essential oils from *Cyperus polystachyos* Rottb. *Cyperus globosus* Allioni and *Cyperus difformis* L. *Nipp. Nogei. Kais.,* 53(10), 343-347
107. Jha V, Patel R, Devkar S, Shaikh MA, Rai D, Walunj S, Koli J, Jain T, Jadhav N, Narvekar S and Shinde R. **2022**. Chemical composition, bioactive potential, and thermal behaviour of *Cyperus scariosus* essential oil. *Chem. Sci. Int. J.*, 4(95), 245-248.
108. Jiang Y, Ownley BH and Chen F. **2018**. Terpenoids from weedy rice field flat sedge (*Cyperus iria* L.) are developmentally regulated and stress induced and have antifungal properties. *Molecules,* 23(12), 3149-3152.
109. Johnson RH and Wallace Jr JW. **1988**. Taxonomic implications of the flavonoids of *Cymophyllus fraseri* (Cyperaceae). *Biochem. Syst. Ecol.*, 16(6), 521-523.

110. Kawabata J, Ichikawa S, Kurihara H and Mizutani J. **1989**. Kobophenol A, a unique tetrastilbene from *Carex kobomugi* Ohwi (Cyperaceae). *Tetrahedron Lett.*, 30(29), 3785-3788.
111. Kawabata J, Mishim M, Kurihara H and Mizutani J. **1991**. Kobophenol B, A tetrastilbene from *Carex pumila*. *Phytochemistry*, 30, 645-647.
112. Kennedy DN, Felix LM, Thomas RH and Simon MNE. **2016**. Isolation and characterization of sclerienone C from *Scleria striatinux*. *Nat. Prod. Commun.*, 11(1), 5-6.
113. Kennedy DN, Kang FN, Hoye TR and Simon MNE. **2017**. Antiparasitic sesquiterpenes from the Cameroonian spice *Scleria striatinux* and preliminary *in vitro* and *in silico* DMPK assessment. *Nat. Prod. Bioprospect*., 7(3), 235-247.
114. Kennedy DN, Karine IN, Reto B, Sergio W, Mbah J, Felix M, Akam M, Clarie W, Simon E and Kurt H. **2008**. Occurrence of sesquiterpene derivatives in *Scleria striatonux* De Wild (Cyperaceae). *Nat. Prod. Commun*., 4(1), 5-8.
115. Kim DK. **2016**. Tetrastilbenes from the aerial parts of *Carex dimorpholepis* Steudel. *Kor. J. Pharm*., 47(4), 307-311.
116. Kiuchi F, Shibuya M and Kinoshita T. **1983**. Inhibition of prostaglandin biosynthesis by the constituents of medicinal plants. *Chem. Pharm. Bull*., 31(10), 3391-3396.
117. Koichiro K and Kunikazu U. **1981**. Secondary metabolic compounds in purple nutsedge (*Cyperus rotundus* L.) and their plant growth inhibition. *Plant Growth Regul*., 6(1), 32-37.
118. Komai K and Tang CA. **1989**. Chemotype of *Cyperus rotundus* in Hawaii. *Phytochemistry*, 28, 1883-1886.
119. Komai K, Shimizu M, Tang CT and Tsutsui H. **1994**. Sesquiterpenoids of *Cyperus bulbosus, Cyperus tuberosus* and *Cyperus rotundus*. *Mem. Fac. Fish., Hokkaido Univ*., 27, 39-45.
120. Kubmarawa D, Ogunwande IA, Okorie DA, Olawore NO and Kasali AA. **2005**. Chemical constituents of the volatile oil of *Cyperus esculentus* L. from Nigeria. *Flavour Fragr. J*., 20, 640-641.
121. Kumar A, Niranjan A, Lehri A, Srivastava RK and Tewari S. **2016**. Effect of geographical climatic conditions on yield, chemical composition and carbon isotope composition of nagarmotha (*Cyperus scariosus* R. Br.) *J. Essent. Oil-Bear. Plants,* 19(2) 368-373.
122. Kurihara H, Kawabata J, Ichikawa S and Mizutani J. **1990**. (−)-ε-Viniferin and related oligostilbenes from *Carex pumila* Thunb. (Gyperaceae). *Agr. Biol. Chem*., 54, 1097-1099.
123. Kurihara H, Kawabata J, Ichikawa S, Mishima M and Mizutani J. **1991**. Oligostilbenes from *Carex kobomugi, Phytochemistry*, 30(2), 649- 653.
124. Lawal OA and Oyedeji AO. **2009**. The composition of the essential oil from *Cyperus distans* rhizome. *Nat. Prod. Commun*., 4(8), 147-149.

125. Lawal OA, Ogunwande IA, Opoku AR and Oyedeji AO. **2016**. Chemical composition and antibacterial activity of essential oils from the rhizomes of *Cyperus papurus* L., grown in South Africa. *B Latinoam Caribe PL.*, 15(3), 136-143.
126. Lee SH, Shin NH, Kang SH, Park JS, Chung SR and Min KR. **1998.** Alpha viniferin: A prostaglandin H2 synthase inhibitor from root of *Carex humilis. Planta Med*., 64(3), 204-207.
127. Lazarević J, Radulović N, Palić R and Zlatković B. **2010**. Chemical composition of the essential oil of *Cyperus glomeratus* L. (Cyperaceae) from Serbia. *J. Essent. Oil Res.*, 22(6), 578-581.
128. Lee JH, Cho HS, Joo SW, Regmi SC, Kim JA, Ryu CM, Cho MH and Lee J. **2013**. Diverse plant extracts and *trans*- resveratrol inhibit biofilm formation and swarming of *Escherichia coli* O157: H7. *Biofouling*, 29(10), 1189-1203.
129. Lew JH, Kwak JH, Lee KR and Zee OP. **1998**. Flavonoids from *Kyllinga brevifolia* var. *leiolepsis*. *Korean J. Pharmacogn*., 29(2) 71-74.
130. Liya L, Geneive EH and Seeram NP. **2009**. Identification and bioactivities of resveratrol oligomers and flavonoids from *Carex folliculata* seeds. *J. Agric. Food Chem.*, 57(16), 7282-7287.
131. Lopéz-Cortés I, Salazar-García DC, Malheiro R, Guardiola V and Pereira JA. **2013**. Chemometrics as a tool to discriminate geographical origin of *Cyperus esculentus* L. based on chemical composition. *Ind. Crops Prod.*, 51, 19-25.
132. Mahmout Y, Bessiere JM and Dolmazon R. **1993**. Composition of the essential oil from *Kyllinga erecta* S. *J. Agric. Food Chem*., 41(2), 277-279.
133. Mahmout Y, Bessiere JM and Dolmazon R. **1993**. Hydroxymanoyloxides from *Kyllinga erecta*. *Phytochemistry,* 34(3), 865-867.
134. Mahmout Y, Bessiere JM and Dolmazon R. **2001**. Volatile constituents of *Kyllinga erecta*. S. *Bull. Chem. Soc. Ethiop*., 15(1), 39-46.
135. Maia JGS, da Silva MH, Andrade EHA and Rosa NA. **2005**. Essential oil composition of *Scleria hirtella* Swartz (Cyperaceae). *Flavour Frag. J.*, 20 (5), 472-473.
136. Majeed M, Nagabhushanam K, Bhat B, Ansari M, Pandey A, Bani S and Mundkur L. **2022**. The anti-obesity potential of *Cyperus rotundus* extract containing piceatannol, scirpusin A and scirpusin B from rhizomes: Preclinical and clinical evaluations. *Diabetes Metab. Syndr. Obes.*, 9(15), 369-382.
137. Masanori M, Yoshiyuki S, Ryoko M and Koichiro K. **2001**. Electron Transport Inhibitor in *Cyperus javanicus*. *Biosci. Biotechnol. Biochem*., 65(8),1849-1851.
138. Mashaly IA. El-Halawany EF and Abd El-Gawad AM. **2007**. Fodder potentiality and ecology of some non-conventional forage weeds in the Nile Delta region, Egypt. *Egypt. J. Bot*., 47, 119-142.
139. Mbah JA, Ngemenya MN, Abawah AL, Babiaka SB, Nubed LN, Kennedy DN, Lemuh ND and Simon MNE. **2012**. Bioassay guided discovery of antibacterial

agents: *invitro* screening of *Peperomia vulcanica*, *Peperomia fernandopoioana* and *Scleria striatinux*. *Ann. Clin. Micro. Antimicro.*, 11, 10-13.

140. Memariani T, Hosseini T, Kamali H, Mohammadi A, Ghorbani M, Shakeri A Spandidos DA, Tsatsakis AM and Shahsavand S. **2016**. Evaluation of the cytotoxic effects of *Cyperus longus* extract, fractions and its essential oil on the PC3 and MCF7 cancer cell lines. *Oncol. Lett.*, 11(2), 1353-1360.
141. Meng Y, Bourne PC, Whiting P, Sik V and Dinan L. **2001**. Identification and ecdysteroid antagonist activity of three oligostilbenes from the seeds of *Carex pendula* (Cyperaceae). *Phytochemistry*, 57, 393-400.
142. Mittas D, Mawuna M, Magliocca G, Lautenschlager T, Schwaiger S, Stuppner H and Marzocco S. **2022**. Bioassay-Guided isolation of anti-inflammatory constituents of the subaerial parts of *Cyperus articulates* (Cyperaceae). *Molecules*, 27(18), 5937-5940.
143. Mogib MA, Basaif SA and Ezmirly ST. **2000**.Two novel flavans from *Cyperus conglomeratus*. *Pharmazie*, 55(9), 692-695.
144. Morikawa T, Xu F, Matsuda H and Yoshikawa M. **2010**. Structures of novel norstilbene dimer, longusone A, and three new stilbene dimers, longusols A, B, and C, with antiallergic and radical scavenging activities from Egyptian natural medicine *Cyperus longus*. *Chem. Pharm. Bull.*, 58(10), 1379-1385.
145. Morikawa T, Xu F, Matsuda H and Yashikawa M.**2002**. Structures and radical scavenging activities of novel nor-stilbene dimer, longusone A, and new stilbene dimer, longusone A, B, and C, from Egyptian herbal medicine *Cyprus longus*. *Heterocycles*, 57(11), 1983-1988.
146. Morimoto M, Fujii Y and Komai K. **1999**. Antifeedants in Cyperaceae: Coumaran and quinones from *Cyperus* spp., *Phytochemistry*, 51(5), 605- 608.
147. Morimoto M and Komai, K. **2005**. Plant growth inhibitors: Patchoulane-type sesquiterpenes from *Cyperus rotundus* L. *Weed Biol. Manag.*, 5(4), 203-209.
148. Mve-Mba CE, Menut C, Lamaty G, Zollo PHA, Tchoumbougnang F and Bessiére JM. **1996.** Aromatic Plants of Tropical Central Africa. XXV. Volatile components from rhizomes of *Scleria striatinux* De Wild, from Cameroon. *J. Essent. Oil Res*., 8(1), 59-61.
149. Nakajima K, Taguchi H, Endo T and Yosioka I. **1978**. Constituents of *Scirpus fluviatilis* (Torr.) A. Gray. I. The structures of new hydroxystilbene dimers, scirpusin A and B. *Food Agri. Org. UN.*, 3050-3057.
150. Nassar MI, Abu-Mustafa EA, Abdel-Razik AF and Dawidar AM. **2000**. Lipids and flavonoids from some Cyperaceae plants and their anti-microbial activity. *Bull. Nat. Res. Centre.*, 25, 105-113.
151. Nassar MI, Abu-Mustafa EA, Abdel-Razik AF and Dawidar AM.**2002**. A new flavanan isolated from *Cyperus conglomeratus*. *Pharmazie*, 53(11), 806-807.

152. Nassar MI, Abdel-Razik AF, El-Khrisy EEDA, Dawidar AAM, Bystrom A and Mabry TJ. **2002**. A benzoquinone and flavonoids from *Cyperus alopecuroides*. *Phytochemistry*, 60(4), 385-387.
153. Nassar MI, Yassine YM, Elshamy AI., El-Beih AA, El-Shazly M andSingab ANB. **2015**. Essential oil and antimicrobial activity of aerial parts of *Cyperus leavigatus* L. (Family: Cyperaceae). *J. Essent. Oil-Bear. Plants*, 18(2), 416-422.
154. Neetin Desai. **2020**. Hydrophytic plants *Canna indica*, *Epipremnum aureum*, *Cyperus alternifolius* and *Cyperus rotundus* for phytoremediation of fluoride from water. *Envir. Tech. Inno*., 21, 101234.
155. Neisen DB, Ma H, Yuan T, Bach AC, Henry GE and Seeram NP. **2015**. Phenolic constituents of *Carex vulpinoidea* seeds and their tyrosinase inhibitory activity. *Nat. Prod. Commun*., 10(3), 491-493.
156. Nerali SB, Kalsi PS, Chakravarti KK and Bhattacharyya SC. **1965**. Terpenoids LXXVII. Structure of isopatchoulenone, a new sesquiterpene ketone from the oil of *Cyperus scariosus*. *Tetrahedron Lett.*, 6(45), 4053-4056.
157. Neville GA, Nigam IC and Holmes JL. **1968**. Identification of ketones in *Cyperus*: NMR and mass spectral examination of the 2, 4-dinitrophenylhydrazones. *Tetrahedron*, 24(10), 3891-3897.
158. Nigam IC. **1965**. Essential oils and their constituents XXXI. Cyperenone- a new sesquiterpene ketone from oil of *Cyperus scarosius*. *Int. J. Pharm. Sci. Rev. Res*., 54(12), 1823-1825.
159. Noori M, Dehshiri M and Mehrdost N.**2012**. Root flavonoids of some Iranian *Scirpus* L. (Cyperaceae) members.*Int. J. Bot*., 8, 165-169.
160. Nureni OO, Lamidi AU, Isiaka AO and Kasali AA. **2006**. Constituents of rhizome essential oils of two types of *Cyperus articulatus* L. grown in Nigeria. *J. Essent. Oil Res*., 18(6), 604-606.
161. Nyasse B, Tih RG, Sondengam BL, Martin MT and Bodo B. **1988**. Mandassidione and other sesquiterpenic ketones from *Cyperus articulates*. *Phytochemistry*,27(10), 3319-3321.
162. Ohira S, Hasegawa T, Hayashi KI, Hoshino T, Takaoka D and Nozaki H. **1998**. *Cyperus rotundus* active compounds for Psoriasis therapy with *in silico* analysis. *Phytochemistry*, 47, 1577-1581.
163. Okoye JI and Ene GI. **2018**. Effect of Processing on the nutrient and anti-nutrient contents of Tiger Nut (*Cyperrus esculentus* Lativum). *J. Food Tech. Food Chem.*, 1, 101.
164. Oladipupo AL and Adebola O. **2009**. The composition of the essential oil from *Cyperus distans* rhizome. *Nat. Prod. Commun.*, 4(8), 1099-1102.
165. Olukanni OD, Abiola T, Olukanni AT and Ojo AV. **2022**. Chemical composition, *in silico* and *in vitro* antimutagenic activities of ethanolic and aqueous extracts of Tiger nut (*Cyperus esculentus*). *Prev. Nutr. Food Sci.*, 27(30), 198-211.

166. Pandey AK and Chowdhury AR. **2002**. Essential oil of *Cyperus scariosus* R. Br. tubers from central India. *Indian Perfum*., 46, 325-328.
167. Pascual B, Maroto JV, LóPez-Galarza S, Sanbautista A and Alagarda J. **2000**. Chufa (*Cyperus esculentus* L. var. *sativus*boeck.): Un cultivo no convencional. estudiossobre sus usos y sucultivo. *Econ. Bot*., 54, 439-448.
168. Paudel P, Satyal P and Setzer WN. **2012**. Leaf essential oil composition of *Kyllinga brevifolia* Rottb. from Nepal. *J. Essent. Oil-Bear. Plants*, 15(2), 854-857.
169. Pelegrin CJ, Ramos M, Jimenez A and Garrigos MC. **2022**. Chemical composition and bioactive antioxidants obtained by microwave assisted extraction of *Cyperus esculentus* L. by products: A valorizarion approach. 2022. *Front. Nutr*., 8(9), 944830.
170. Powell RG, Bajaj R and McLaughlin JL. **1987**. Bioactive stilbenes of *Scirpus maritimus. J. Nat. Prod*., 50, 293-296.
171. Rajak P and Ghosh A. **2022**. RP-HPLC based analysis of different polyphenols in seven species of *Carex* L. (Cyperaceae Juss.) from West Bengal, India. *Biodivers. J., Biol. Diver*., 23(5), 2329-2341.
172. Raju HV. **2007**. Pharmacognostic Studies on *Kyllinga monocephala*. *Indian J. Nat. Prod. Resour*., 2, 33-36.
173. Rameshkumar KB, Sudheesh N and George V. **2009**. Essential oil composition of *Scleria lithosperma* (L). *Indian Perf.*, 53, 46-47.
174. Rettig JH, and Giannasi DE. **1990**. Foliar flavonoids of the *Carex nigromarginata* complex (sect. Acrocystis, Cyperaceae). *Biochem. Syst. Ecol*., 18(6), 393-397.
175. Ricci A, Fiorentino A, Piccolella S, Golino A, Pepi F, D'Abrosca B, Letizia M and Monaco P. **2008**. Furofuranic glycosylated lignans: a gas-phase ion chemistry investigation by tandem mass spectrometry. *Rapid Commun. Mass Spectr.*, 22, 3382-3392.
176. Robert HJ and James WW. **1988**. Taxonomic implications of the flavonoids of *Cymophyllus fraseri* (Cyperaceae). *Biochem. Syst. Ecol*., 16(6), 521-523
177. Rosado MJ, Marques G, Rencoret J, Gutiérrez A, Bausch F, Rosenau T,Potthast A and Del Río JC. **2022**. Chemical composition of the lipophilic compounds from the rind and pith of papyrus (*Cyperus papyrus* L.) stems. *Front. Plant Sci.*, 13, 5378.
178. Saeed MM, Fernández-Ochoa Á, Saber FR, Sayed RH, Cádiz-Gurrea MdlL, Elmotayam AK, Leyva-Jiménez FJ, Segura-Carretero A and Nadeem RI. **2022**. The potential neuroprotective effect of *Cyperus esculentus* L. extract in scopolamine-induced cognitive impairment in rats: Extensive biological and metabolomics approaches. *Molecules*, 27, 7118.
179. Saeed M, Sharif A, Hassan SU, Akhtar B, Muhammad F and Malik M. **2022**. *Cyperus iria* aqueous-ethanol extract ameliorated hyperglycemia, oxidative stress, and regulated inflammatory cytokines in streptozotocin-induced diabetic rats. *Environ. Sci. Pollut. Res. Int.*, 29(3), 4769-4784.

180. Sayed HM, Mohamed MH, Farag SF and Mohamed GA. **2001**. Phytochemical and biological studies of *Cyperus rotundus* L. growing in Egypt. *Bull. Pharm. Sci*., Cairo Univ., 39,195-203.
181. Sayed HM, Mohamed MH, Farag SF, Mohamed GA, Ebel R, Omobuwajo ORM and Proksch P. **2006**. Phenolics of *Cyperus alopecuroides* Rottb. inflorescences and their biological activities. *Bull. Pharm. Sci*., *Assiut Univ*., 29(1), 9-32.
182. Schmeda-Hirschmann G, Gutierrez MI, Loyola I and Zuniga J. **1996**. Biological activity and xanthine oxidase inhibitors from *Scirpus californicus* (C.A.Mey.) Steud. *Phy. Therp. Res.,* 10(8), 683-687.
183. Seabra RM, Andrade PB, Ferreres F, Moreira MM. **1997**. Methoxylated aurones from *Cyperus capitatus*. *Phytochemistry,* 45(4), 839-840.
184. Seabra RM, Moreira MM, Costa MAC and Paul MI. **1995**. 6,3’,4’-Trihydroxy-4-methoxy-5-methylaurone from *Cyperus capitatus*. *Phytochem.,* 40(5), 1579-1580.
185. Seabra RM, Silva AMS, Andrade PB and Moreira MM. **1998**. Methylaurones from *Cyperus capitatus*. *Phytochemistry,* 48(8), 1429-1432.
186. Seo H, Kim M, Kim S, Mahmud HA, Islam MI, Nam KW, Cho ML, Kwon HS and Song HY. **2017**. *In vitro* activity of alpha viniferin isolated from the roots of *Carex humilis* against *Mycobacterium tuberculosis.Pul. Pharm. Therp*., 46, 41- 47.
187. Singh NB and Singh PN. **1986**. A new flavanol glycoside from mature leaves of *Cyperus rotundus*. *J. Indian Chem. Soc*., 63, 450-455
188. Singh R. **2016**. Chemotaxonomy: a tool for plant classification. *J. Med. Plant Res.,* 4(2), 90-93.
189. Smith TA. **1977**. Phenethylamine and related compounds in plants. *Phytochemistry,* 16(1), 9-18.
190. Sonwa MM and Konig WA. **1997.** Sesquiterpenes from the essential oil of *Cyperus alopecuroides*. *Phytochemistry,* 45(7), 1435-1439.
191. Sonwa MM and König WA. **2001**. Chemical study of the essential oil of *Cyperus rotundus*. *Phytochemistry*, 58, 799-810.
192. Suzuki K, Shimizu T, Kawabata J and Mizutani J. **1987**. New 3,5,4′-Trihydroxystilbene (resveratrol) oligomers from *Carex fedia* Nees var. *miyabei* (Franchet) T. Koyama (Cyperaceae). *Biosci. Biotech. Biochem*., 51(4), 1003-1008.
193. Taheri Y, Herrera-Bravo J, Huala L, Salazar LA, Sharifi-Rad J, Akram M, Shahzad K, Melgar-Lalanne G, Baghalpour N, Tamimi K, Mahroo-Bakhtiyari J, Kregiel D, Dey A, Kumar M, Suleria HAR, Cruz-Martins N and Cho WC. **2021.** *Cyperus* spp.: A review on phytochemical composition, biological activity, and health-promoting effects. *Oxid. Med. Cell Longev.,* 4014867, 1-17.
194. Taiba FA and Azhar AS. **2022**. Chemical study of some species for *Cyperus* L. (Cyperaceae) in Diwaniyah River using gas chromatography- mass spectrometry. *Int. J. Acad. Mang. Sci. Res.,* 6(3), 17-33.
195. Tucker AO, Maciarello MJ and Bryson CT. **2006**. The essential oil of *Kyllinga odorata* Vahl (Cyperaceae) from Mississippi. *J. Essent. Oil Res.,* 18, 381-382.
196. Uppal SK, Chhabra BR and Kalsi PS. **1984**. Biogenetically important hydrocarbons from *Cyperus scariosus*. *Phytochemistry,* 23(10), 2367-2369.
197. Van Aller RT, Clark LR, Pessoney GF and Van Rogers A. **1983**. A prostaglandin like fatty acid from a species in the Cyperaceae. *Lipids,* 18(9), 617-622.

198. Vega-Morales T, Mateos-Diaz C, Pérez-Machín R, Wiebe J, Gericke NP, Alarcón, C and Lopez-Romero JM **2019**. Chemical composition of industrially and laboratory processed *Cyperus esculentus* rhizomes. *Food Chem.*, 297, 124896.
199. Venkatachalam M and Sathe SK. **2006**. Chemical composition of selected edible nut seeds. *J. Agr. Food Chem.*, 54 (13), 4705-4714.
200. Verma N Jha KK, Ahmad S, Chaudhary S and Ali M. **2017**. Phytochemical investigation and characterization of isolated chemical constituents from *Kyllinga triceps* Rottb. *Asian J. Chem.*, 29(6), 1393-1400.
201. Vian MA, Fernandez X, Visinoni F and Chemat F. **2008**. Microwave hydro diffusion and gravity, a new technique for extraction of essential oils. *J. Chromatogr. A.,* 1190, 14-17.
202. Vilhena, KSS, Guilhon GMSP, Zoghbi MGB, Santos LS and Souza Filho APS. **2014**. Chemical investigation of *Cyperus distans* L. and inhibitory activity of scabequinone in seed germination and seedling growth bioassays. *Nat. Prod. Res*., 28 (23), 2128-2133.
203. Williams CA and Harborne JB. **1977**. Flavonoid chemistry and plant geography in the cyperaceae. *Biochem. Syst. Ecol.*, 5, 45-51.
204. Yamada M, Hayashi K, Hayashi H and Ikeda S. **2006.** Stilbenoids of *Kobresia nepalensis* (Cyperaceae) exhibiting DNA topoisomerase II inhibition. *Phytochemistry*, 67(3), 307-313.
205. Yamada M, Hayashi KI, Hayashi H, Tsuji R, Kakumoto K, Ikeda S, Hoshino T, Tsutsui, K, Tsutsui K and Ito T. **2006**. Nepalensinols D-G, new resveratrol oligomers from *Kobresia nepalensis* (Cyperaceae) as potent inhibitors of DNA topoisomerase II. *Chem. Pharm. Bull*., 54, 354-358.
206. Yang GL, Zhang and Chen G. **2010**. Determination of four phenolic compounds in *Scirpus yagars* Ohwi by CE with amperometric detection. *Chromatographia*, 71, 143-147.
207. Yeoh HH, Wee YC and Watson L. **1986**. Taxonomic variation in total leaf protein amino acid compositions of monocotyledonous plants. *Biochem. Syst. Ecol*., 14(1), 91-96.
208. Yoshikawa M, Morikawa T, Xu F and Matsuda H. **2002**. Structures and radical scavenging activities of novel norstilbene dimer, longusone A and new stilbene dimers, longusols A, B and C from Egyptian herbal medicine *Cyperus longus*. *Heterocycles*, 57(11), 147-154.
209. Zhang S, Li P, Wei Z, Cheng Y, Liu J, Yang Y, Wang Y and Mu Z. **2022**. *Cyperus* (*Cyperus esculentus* L.): A Review of its compositions, medical efficacy, antibacterial activity and allelopathic potentials. *Plants*, 11, 1127.
210. Zhou Z and Zhang H. **2013**.Phenolic and iridoid glycosides from the rhizomes of *Cyperus rotundus* L. *Med. Chem. Res*., 22, 4830-4835.
211. Zoghbi MDGB, Andrade EHA, Oliveira J, Carreira LMM and Guilhon GMS. **2006**. Analysis of the essential oil of the rhizome of *Cyperus giganteus* Vahl. (Cyperaceae) cultivated in the north of Brazil.*J. Essent. Oil Res*., 18, 408-410.