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Terpenoids Associating Medicinal Plants and Its Values in Pharmacognosy: An Overview

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Abstract: ***Terpenoids are important chemical constituents of medicinal plant. These are basically hydrocarbons. This type of constituent is usually found in many pants like Dill, Caraway, Fennel, Nutmeg, Cinnamon, Tulsi, Eucalyptus, Chenopodium, Ajowan, Coriander, Cardamom, etc across the World. Various types of terpenoids like Myrene, Ocimene, Nneral, Geranial, Nerol, Geraniol, Phellandral, Perillaldehyde, Santonin, Cadalene, Manool, Lanosterol, Squalene, Lupeol, Betulin, etc are observed in various plants. These constituents can be used carminative, stimulant, flavoring agent, anthelmintics, expectorant, antiseptic, rubefacient, antispasmodic agent, etc. Terpenoids are found in India, China, Europes, USA, Japan, Russia, Indonesia, Caribbean islands, etc. This review article deals with the classifications of terpenoids and role of medicinal plants with terpenoids in details.***

Keywords: Terpenoids, Dill, Caraway, Fennel, Nutmeg, Cinnamon, Tulsi, Eucalyptus, Chenopodium, Ajowan, Coriander, Cardamom.

I. INTRODUCTION

Terpenoids are present in many species of plants like Dill, Caraway, Cardamom, Fennel, Ajowan, Nutmeg, Black Pepper, Tulsi, Cinnamon, Coriander, Clove, etc across the different parts of World like Asia, Europe, USA, etc. Chemically it is hydrocarbon in where it should follow the isoprene unit rule (C_5H_8). It is identified by Sudan III chemical in where plant drug is treated with alcoholic Sudan III. Red color shows the presence of volatile oils in terpenoids. Terpenoids are insoluble in water but dissolve in organic solvents. These are colorless solid or liquid with a pleasant, aromatic and characteristic odor. It has optical activity. The terpenoids are having the portions of terpenes, ketones, alcohols, acids, aldehydes and esters. Terpenoids are oxidized easily. It also can be identified by treating the plant part with tincture alkane drop and showing red color. Red color indicates the presence of volatile oils. Different types of family members like Umbelliferae, Liliaceae, Labiatae, Lauraceae, Zingiberaceae, Rutaceae, Myristicaceae, Myrtaceae, etc are observed among the plants belonging from terpenoids. Chemical constituents like Nerol, Phellandral, Geraniol, Betulin, Manool, Lupeol, etc are showing different activities like anthelmintics, antiseptic, antispasmodic, stimulant, carminative, expectorant, flavoring agent, rubefacient, etc. Terpenoids are present in volatile oil. [1-3].

II. CLASSIFICATION OF TERPENES

The classification of terpenes is given in the following table 1.

Table 1: Descriptions of Terpenoids [1, 3-4]

Sl. No.	Types	Molecular Formula	No. of Carbon Atoms	No. of Hydrogen Atoms	No. of Isoprene Units
1	Hemiterpene	C_5H_8	5	8	1
2	Monoterpene	$C_{10}H_{16}$	10	16	2
3	Sesquiterpene	$C_{15}H_{24}$	15	24	3
4	Diterpene	$C_{20}H_{32}$	20	32	4
5	Sesterterpenes	$C_{25}H_{40}$	25	40	5
6	Triterpenes	$C_{30}H_{48}$	30	48	6
7	Tetraterpenes	$C_{40}H_{64}$	40	64	8
8	Pentaterpenes	$C_{50}H_{80}$	50	80	10
9	Polyterpenes	$(C_5H_8)_n$	>50	>80	n

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III. CHEMICAL CONSTITUENTS OF TERPENOIDS

The chemical constituents of terpenoids are given in the following table 2.

Table 2: Chemical Constituents of Terpenoids [1, 3-8]

Sl. No.	Terpenes	Sub-divisons	Chemical Constituents
1	Monoterpenes	Acyclic Monoterpenes	Myrcene, Nerol
		Monocyclic Monoterpenes	Menthol, Phellandral
2	Sesquiterpenes	Monocyclic Sesquiterpenes	Zingiberene
		Bicyclic Sesquiterpenes	Cadalene, Santonin
3	Diterpene	Acyclic Diterpenes	Phytol
		Monocyclic Diterpenes	Vitamin A_1
		Bicyclic Diterpenes	Manool
		Tricyclic Diterpenes	Abietic Acid, Podocarpic Acid
4	Triterpenes	Acyclic Triterpenes	Squalene
		Tetracyclic Triterpenes	Agnosterol, Lanosterol
		Pentacyclic Triterpenes	Asiatic Acid, Ursolic Acid, Glycyrrhetic Acid, Betulin, Lupeol

IV. ALLOCATION OF TERPENOIDS ALONG WITH MEDICINAL PLANTS

Table 3: Medicinal Plants with Terpenoids in Details

Sl. No.	Plant Name	Scientific Name	Family Name	Parts Used	Chemical Constituents	Uses	References
1	Coriander	*Coriandrum sativum*	Umbelliferae	Dried ripe fruits	Coriandrol, Geraniol, Pinene, L-borneol	Carminative, Stimulant, Aromatic, Flavoring agent	[1, 9-10]
2	Dill	*Anethum graveolens*	Umbelliferae	Dried ripe fruits	Carvone, D-limonene, Dihydrocarvone, Phellandrene	Carminative, Stimulant, Aromatic, Also used in gastric problems	[1, 11-12]
3	Ajowan	*Trachyspermum ammi*	Umbelliferae	Dried ripe fruits	Thymol, Pinene, p-cymene	Carminative, Stimulant, Antispasmodic, Antiseptic, Insecticide, Antifungal, Anthelmintic, Flavoring agent Also used in bronchitis	[1, 13-14]
4	Fennel	*Foeniculum vulgare*	Umbelliferae	Dried ripe fruits	Anethole, Fenchone, Phellandrene, Limonene, Methyl chavicol	Carminative, Stimulant, Aromatic, Flavoring agent, Expectorant	[1, 15-16]
5	Cardamom	*Elettaria cardamomum*	Zingiberaceae	Dried ripe fruits	Borneol, α-terpineol, Cineole	Carminative, Stimulant, Aromatic, Flavoring agent	[1, 17-18]
6	Caraway	*Carum carvi*	Umbelliferae	Dried ripe fruits	Carvacrol, Carvone, Limonene, Dihydro carvone	Carminative, Flavoring agent, Stimulant, Aromatic, Spice	[1, 19-20]

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7	Spearmint	*Mentha spicata*	Labiatae	Dried leaves and flowering tops	Pinene, Phellandrene, Cineole, Linalool, l-carvone	Carminative, Flavoring agent	[1, 21-22]
8	Nutmeg	*Myristica fragrans*	Myristicaceae	Dried kernels from the seeds	Saffrole, Elimicin, Myristicin, Geraniol, d-camphene	Carminative, Flavoring agent, Stimulant, Aromatic	[1, 23-24]
9	Anise	*Pimpinella anisum*	Umbelliferae	Dried ripe fruits	Anisaldehyde, Chavicol, Methyl chavicol	Carminative, Expectorant, Stimulant, Flavoring agent, Used in production of dentifrices	[1, 25-26]
10	Celery	*Apium graveolens*	Umbelliferae	Dried ripe fruits	d-limonene, d-selinine, sedanolide, sedanoic acid	Carminative, Stimulant, Tonic, Sedative, Flavoring agent, also used for the treatment of rheumatism	[1, 27]
11	Black Pepper	*Piper nigrum*	Piperaceae	Dried unripe fruit	Piperine, Piperidine, Caryophyllene, l-phellandrene	Carminative, Stimulant, Aromatic, Stomachic, Spice	[1, 28-30]
12	Cumin	*Cuminum cyminum*	Umbelliferae	Dried ripe fruits	Cuminaldehyde, Pinene, Hydrocuminine, Cuminic alcohol, Phellandrene	Carminative, Stimulant, Used in the treatment of dyspepsia and diarrhoea	[1, 31-32]
13	Tulsi	*Ocimum Sanctum*	Lamiaceae	Fresh as well as dried leaves	Eugenol, Ccarvacrol, Methyl eugenol, Caryophylline	Antibacterial, Spasmolytic, Stimulant, Insecticidal, Expectorant, Aromatic, Anti-inflammatory, Stomachic	[1, 33-36]
14	Rasna	*Alpinia officinarum*	Zingiberaceae	Dried rhizomes	Pinene, Cineole, Alpinol, Galangol, Dioxyflavnol, Galangin	Antibacterial, Aromatic, Carminative, Stimulant, Anti-rheumatic	[1, 37-38]
15	Shati	*Hedychium spicatum*	Zingiberaceae	Dried rhizomes (sliced)	8-caryophyllene, Cineole, Limonene	Stomachic, Carminative, Stimulant, Tonic, Aromatic	[1, 39-42]
16	Garlic	*Allium sativum*	Liliaceae	Bulb	Allicin, Alliin	Aphrodisiac, Carminative,	[1, 43-44]

						Stimulant, Expectorant, Anti-dysentery, Antibacterial, Condiment, Anthelmintics, Disinfectant, Rubefacient	
17	Arnica	*Arnica montana*	Compositae	Dried flowering tops and heads	Helenalin, Arnifolin, Epoxyhelanalin, 13-dehydrohelenalin	Cosmetic, Anti-rheumatic, Anthelmintics, Antitumor, Antihyperlipidemic, Antifungal, Anti-inflammatory	[1, 45-46]
18	Jatamansi	*Nardostachys jatamansi*	Valerianaceae	Dried rhizomes	Nardostachone, Jatamansone	Antispasmodic, Sedative, Diuretic, Stomachic, Emmenagogue, Stimulant, Anti-epileptic, Anti-arrhythmic, Flavoring agent, Hair tonic	[1, 47-48]
19	Cinnamon	*Cinnamomum zeylanicum*	Lauraceae	Dried inner bark of the shoot	Eugenol, Caryophyllene, Cymene, Pinene, Phellandrene	Carminative, Mild astringent, Stomachic, Antiseptic, Aromatic, Stimulant, Condiment, Spice, Also used in the preparation of perfumes and dentifrices	[1, 49-50]
20	Clove	*Eugenia caryophyllus*	Myrtaceae	Dried flower buds	Eugenol, Caryophyllenes	Carminative, Flavoring agent, Stimulant, Antiseptic, Dental analgesic, Aromatic	[1, 51-52]
21	Crocus	*Crocus sativus*	Iridaceae	Dried stigmas	Crocetin, Picrocrocin	Antispasmodic, Stimulant, Emmenagogue, Coloring gent, Flavoring agent	[1, 53-54]
22	Annatto	*Bixa orellana*	Bixaceae	Dried seeds	Bixin	Antioxidant	[1, 55-56]
23	Valerian	*Valeriana wallichii*	Valerianaceae	Dried rhizomes and roots	Valeric acid, Valtrate, Camphene, Borneol acetate, Valerenic acid	Antispasmodic, Carminative, Stimulant, Antidepressant, Tonic	[1, 57]

24	Cubeb	*Piper cubeba*	Piperaceae	Dried unripe fruits	Cubebin, Cubebic acid Cadinene	Aromatic, Stimulant, Antiseptic, Used in urinary and cough treatment	[1, 58]
25	Saussurea	*Saussurea lappa*	Compositae	Dried roots	Camphene, Dihydrolactone, Costuslactone	Expectorant and used for the treatment of asthma	[1, 59-60]
26	Acorus	*Acorus calamus*	Araceae	Dried rhizomes	Eugenol, Asarone, Acorine, Asaraldehyde	Carminative, Vermifuge, Stimulant, Insect repellant, Flavoring agent, Sedative, Antidepressant, Antiepileptic	[1, 61-63]
27	Feverfew	*Tanacetum parthenium*	Asteraceae	Dried as well as fresh leaves	Camphor, Borneol, Farnesene, Partholide, Chrysanthemolide, Chrysanthemonin, Parthenolide, Chrysanthemin A, Chrysanthemin B	Used for the treatment of arthritis, migraine, fever, vertigo	[1, 64-67]
28	Coleus	*Coleus forskohlii*	Labiatae	Roots	Forskolin, Deoxycoleonol, Coleonol B, Coleonol C, Coleon F, Coleon E	Vasodilator, Used in high blood pressure and glaucoma treatment	[1, 68]
29	Vidang	*Embelia ribes*	Myrsinaceae	Dried fruits	Vilangin, Embelin	Carminative, Astringent, Anthelmintics, Stimulant	[1, 69-70]
30	Bitter Orange Peel	*Citrus aurantium*	Rutaceae	Dried as well as fresh ripe fruits outer part (Pericarp)	Limonene, Citronellal, Citral	Carminative, Aromatic, Stomachic, Flavoring agent, Perfuming agent, Antioxidant, Antimicrobial	[1, 71-72]
31	Rosemary Oil	*Rosmarinus officinalis*	Labiatae	Fresh flowering tops	Borneol, Camphor, Pinene, d-camphene	Carminative, Flavoring agent, Stimulant, Refrigerant, Natural insecticides	[1, 73-76]
32	Oil of Vetiver	*Vetiveria zizanioides*	Gramineae	Roots	Vetiverol, Vetivenol, α-vetivone, β-vetivone	Flavoring agent, Aromatic, Stimulant, Refrigerant, Stomachic, Antibacterial	[1, 77-78]
33	Hops	*Humulus lupulus*	Canniabinaceae	Dried female	Lupulone, Humulone	Spasmolytic, Sedative	[1, 79-81]

				flowers			
34	Artemisia	*Artemisia annua*	Asteraceae	Herb	Caryophyllene, Camphor, Myrcene, Artemisinin, Arteether, Artemisinic acid, Arteannuin B	Anti-malarial, Antioxidant	[1, 82-83]
35	Oil of Sandal Wood	*Santalum album*	Santalaceae	Heart wood	β-santalol, Santenone, Santene, Santalene, Santalone	Used for the treatment of dysurea	[1, 84-86]
36	Davana Oil	*Artemisia pallens*	Compositae	Flowering herbs	Davanone, Cineol, Geraniol, Borneol, Eugenol, Linalool	Flavoring agent, Perfuming gent, Anti-diabetic, Anti-helmintic, Antipyretic, Antibacterial, Antifungal, Used to treat wound healing, Immuno-modulator	[1, 87-88]
37	Citronella Oil	*Cymbopogon nardus*	Graminae	Fresh leaves	Citronellal, Geraniol, d-camphene, Borneol, Methyl eugenol, Linalool, Limonene, Elmicin, Cadinene	Flavoring agent, Perfuming agent, Used in mosquito repellant cream	[1, 89]
38	Lavender Oil	*Lavandula officinalis*	Labiatae	Fresh flowering tops	Linalool, Geraniol, Pinene, Cineol, Linalyl acetate	Carminative, Aromatic, Flavoring agent, Perfuming agent, Antibacterial	[1, 90]
39	Palmarosa Oil	*Cymbopogon martini*	Graminae	Fresh leaves with tops	Geraniol, Linalool, Citronellal	Perfuming agent, Insect repellant, Anti-rheumatic, Bronchodilator, Vasodilator, Spasmolytic	[1, 91-92]
40	Gaultheria Oil	*Gaultheria procumbens*	Ericaceae	Leaves	Gaultherin	Vermicide, Anti-rheumatic, Flavoring agent, Perfuming agent, Antibacterial, Antioxidant	[1, 93-94]
41	Peppermint Oil	*Mentha piperita*	Labiatae	Fresh flowering tops and leaves	l-limonene, Cineole, Pinene, Isopulegone, Camphene, Menthone,	Antiseptic, Carminative, Flavoring agent, Stimulant	[1, 95-96]

					Pulegone, Menthofuran		
42	Lemon Grass Oil	*Cymbopogon flexuausus*	Graminae	Leaves with aerial parts	Citronellal, Citral, Nerol, Geraniol, Methylheptenol	Flavoring agent, Perfuming agent	[1, 97]
43	Geranium Oil	*Pelargonium graveolens*	Geraniaceae	Fresh stems and leaves	Geraniol, β-citronellol	Flavoring agent	[1, 98]
44	Camphor Oil	*Cinnamomum camphora*	Lauraceae	Wood	d-pinene, Camphor, Eucalyptol, Cineole, Eugenol, Phellandrene	Flavoring agent, Rubefacient, Anti-inflammatory, Antioxidant	[1, 99-101]
45	Eucalyptus Oil	*Eucalyptus globulus*	Myrtaceae	Fresh leaves	Eucalyptol, Geranyl acetate, Pinene, Cineole, Phellandrene, Citronellal, Camphene, Pinene	Expectorant, Antiseptics, Used for the treatment of bronchitis and cough	[1, 102-103]
46	Chenopodium Oil	*Chenopodium ambrosioides*	Chenopodiaceae	Fresh flower, leaves, roots and fruit	Ascaridole, Cymene, l-limonene, Myrcene, Camphor	Anthelmintics, Antifungal, Antioxidant, Anti-malarial, Antimicrobial, Anti-inflammatory	[1, 104-112]

V. CONCLUSION

Lots of chemical constituents are present in medicinal plants to show different pharmacological activities. Terpenoids are important constituents among all of constituents. Different types of terpenoids like Geraniol, Nerol, Phellandral, Manool, Lupeol, etc, are showing different roles like anthelmintics, antispasmodic, carminatives, antiseptics, expectorant, etc. The terpenoid plant name like Dill, Caraway, Cardamom, Fennel, Ajowan, Corainder, etc from different plant families like Umbelliferae, Liliaceae, Lauraceae, Zingiberaceae, Rutaceae, Myristicaceae, Labiatae, Myrtaceae, Santalaceae, Piperaceae, etc, are present in all over the world. Presently different research activities are continuing in this topic to show important and newer cum potent pharmacological activities from terpenoids. In near future, we hope that terpenoids may be a promising target for treating so many diseases and problems across the World.

Conflicts of Interest: Nil

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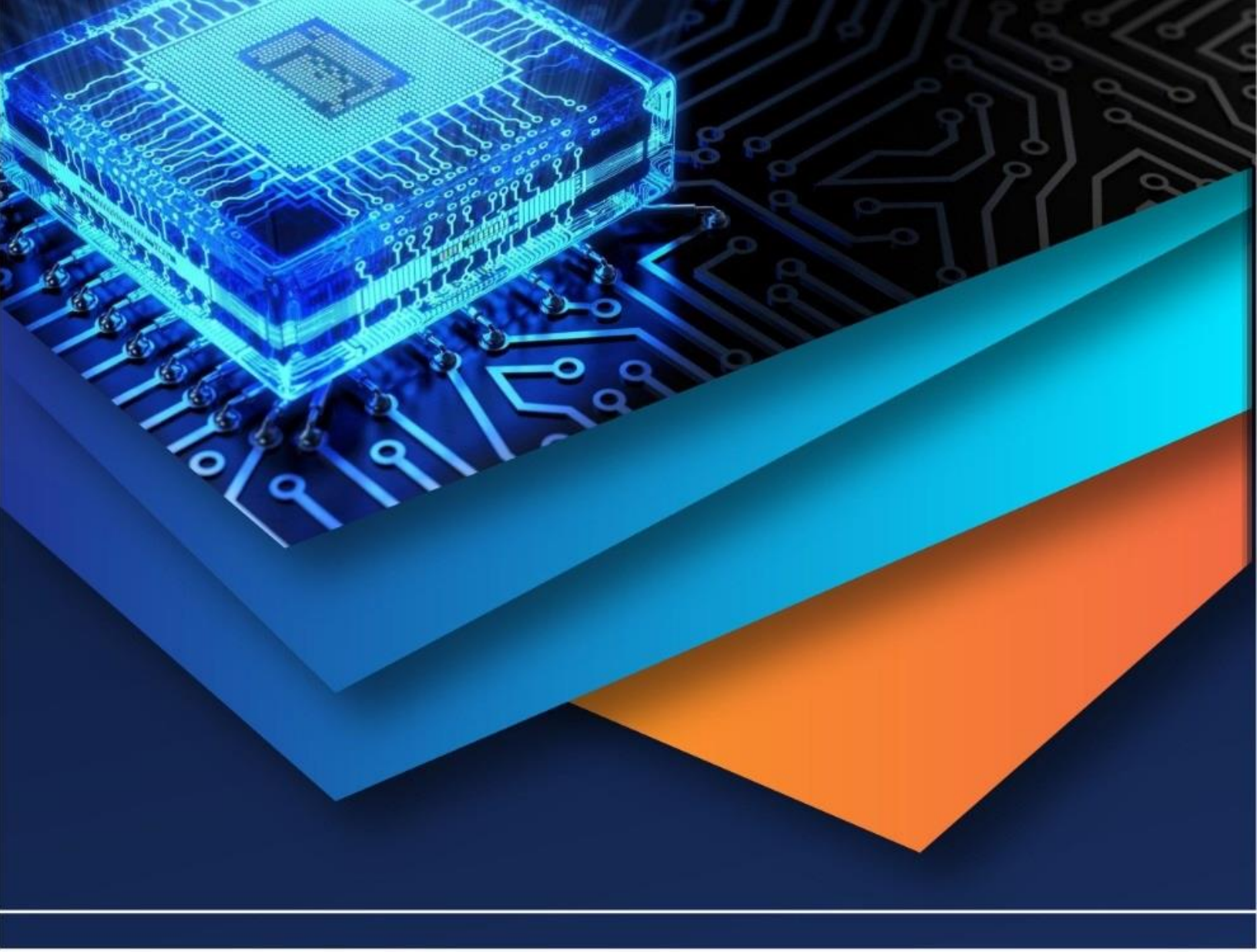
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