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A Review on Callistemon Viminalis

Shweta Yadav*[1], Akash Maurya[2], Deeksha Sonkar[3], Sapna Gupta[4], Dr. Meenakshi Gupta[5]

*[1,2,3,4]Research Scholar, School of Pharmaceutical Sciences, CSJM University, Kanpur.
[5]Senior Assistant Professor, School of Pharmaceutical Sciences, CSJM University, Kanpur.

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ABSTRACT:
Weeping bottlebrush, *Callistemon viminalis*, belongs to Myrtaceae family and is renowned for their therapeutic properties. A decorative plant is known for its many qualities, includingmoluscicidal, antioxidant, antifungal, antibacterial, antiplatelet aggregation, allelopathic,antiinfective, antiquorum sensing,and antihelminthic properties. It was extra found that attractive plants have excellent insecticide properties. Essential Oils, pyrrole derivatives,monoterpenes, triterpenoid, phenolic,steroids, flavonoid, and steroidal glycoside are just a few of the diverse secondary metabolic products . According to prior studies, monoterpenes appear to be the principal components of *C. viminalis* and are primarily responsible for of the plant's various biological functions. In order to further use it for the research, this review covers details on its physiochemical makeup, morphology, cultivation, phytochemistry and microscopic studies in order to further utilise it for the benefit of people.

KEYWORS: *Callistemon viminalis*, Phytoconstituents, Essential oil, Biological activity

I. INTRODUCTION:

Historical evidence suggests that herbal remedies are beneficial to human beings, and due to their wide range of properties, their use has increased exponentially in recent years. Indigenous peoples in far-off places have used herbal medicine since ancient times, and it is frequently used in many developing nations. All forms of life are greatly impacted by the use of synthetic chemicals, which causes an increase in their multiplication. Because of the potential for mild to acute adverse effects because of their complex chemical compositions, scientific research should be well-planned and should evaluate toxicity tests and conventional methods to demonstrate the safety of herbal medications [1].

CLASSIFICATION

Anatomical characteristics are taken into consideration when conducting taxonomical investigations [1]. Approximately 130 genus and 3000 varieties of trees and plants make up the a subtropical temperate, and tropical distribution of the family Myrtaceae, which is primarily accomplish in Australia and tropical America [4]. These include Syzygium aromaticum L., Myrtus communis L.,Psidium guajava L., Eucalyptus camaldulensis, and the*Callistemon viminalis*. The split of these kinds of species was mostly caused by specific structural traits. Several morphological differences have been identified among various plant species. For instance, the leaves of the plants i.e. *C. viminalis* and P. guajava lack stomata on their abaxial surface, while P. guajava leaves possess a hypodermis layer. Additionally, the cross section of stems of *Callistemon viminalis* and/orleaves of E. camaldulensis is wavy, and the mesophyll *Cstrand*, and P. guajava petioles contain prismatic crystals in their druses. These characteristics serve to distinguish these plant species from one another [15].

TAXONOMY OF *C. vimunalis*

Scientificname: *Callistemon viminalis*; **Common names**:WeepingBottlebrush;**Kingdom**:Plantac;**Subkingdom:** Tracheobionta;**Division**: Magnoliophyta; **Class**: Magnoliopsida;**Genus**: Callisternon; **Family**: Myrtaceae;**Order**: Myrtales; **Superdivision**: Spermatophyta; **Uniformity of Crown**: Inegular outline or silhouette; **Shape of Crown**: round: weeping; **Density of Crown**: open; **Rate of Growth**: medium; **Texture**: fine; **Height**: 20 to 15 feet; **Spread**: 20 to 15 feets.

There are around 34 species in the genus Callistemon, 10 of which are found in India. Though widespread throughout the planet, *Callistemon viminalis* is common to a greater extent in Australia, Tropical Aisa, South America, India and Sri Lanka [1-3]. The weeping bottlebrush, *C. viminalis*, is memberof family Myrtaceae. *Callistemon viminalis* is a significant plant of medicinal categories that is

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frequently used in conventional medicine. Additionally, this medicinal herb is utilised to treat respiratory problems, skin condition of infection, and stomachaches [4]. *C. viminalis* mostly utilised in forestry, windbreak planting, essential oil production, ornamental gardening, and the restoration of degraded land [5]. *C. viminalis* is used for a variety of purposes and also demonstrates against earthworms, tapeworms and hookworms the in-vitro antihelmintic activities [6]. Ephestia kuehniella can be successfully managed through the utilization of *C. viminalis*, which induces detrimental effects on the immune system cells of the former. [7]. Gram-positive bacteria were susceptible to leaves and flowers extract of *C. viminalis* [1, 7]. Haemorrhoids are treated with *C. viminalis* in Traditional Chinese Medicine [8]. It also has weed-controlling capacity, making it useful as a bio-indicator in the management of environments [2]. The palatable leaves of *C. viminalis* can be used to make tea and have a beautifully reviving smell and aroma [9]. The strong beverage made from *C. viminalis* was historically used to cure skin diseases, diarrhoea, and gastritis. It possesses hemostatic abilities associated to its astringent effect so it can stop internal bleeding, especially that caused by ulcers, by narrowing blood vessels [4]. *C. viminalis* has been found to exhibit molluscicide properties against Biomphalria alexandrina snails in its leaves, fruits and barks [10]. Recent research has revealed that bottle brush exhibits molluscicidal properties, acts as a bio-repellent against land roaches, possesses insecticidal properties, and demonstrates anti-helminthic effects. [11, 12]. It has anti-thrombin activity in along with its antioxidant and hepatoprotective effects [13, 14]. It is also well known for boosting immunity and defending against chronic illnesses affecting the body's key organs, including the other organs and heart, brain [13]. In order to develop a collective strategy aimed at further developing and establishing efficient alternatives for a number of clinical issues, we have made an effort to investigate the research on *C. viminalis* in the present article, breaching fields related to its morphology, microscopic studies, cultivation, phytochemical, physiochemical, as well as its importance in the framework of pharmacological arena.

CULTIVATION

Ciminalis is a typical ornamental plant that may be found all over the world. This plant does not grow in regions that are particularly cold or dry. It can be located in numerous places. Both in Australia and elsewhere, *C. viminalis* taxa and varieties are frequently planted. *C. viminalis* available in a variety of widely used hybrids [16]. Callistemon 'Captain Cook' is among the most well-known varieties.Australia's east coast was discovered by Captain James Cook in 1770, and this variety was heavily promoted to commemorate the 200th anniversary of that discovery [17]. *C. viminalis* thrives in cultivation where there is a consistent supply of water because it is typically found near watercourses in the wild. Once established, it can withstand prolonged dryness [18]. The plant survives in moderate to dense soil and can tolerate poor drainage, however medium to severe frost can stunt its growth. After flowering, it responds to yearly fertilisation [18]. Even if the plant reacts to trimming, it can damage weeping forms' look. Like most bottlebrush plants, it performs best when planted in a sunny area, however it can tolerate significant exposure along the price of*C. viminalis* flowering performance may grow effectively with little upkeep and is comparatively adaptable to several soil types. Excluding of the particularly dry and cold regions, this plant typically present in a variety of locations [16].

Although *C. viminalis* develops wells during cultivation where there is a reliable water source, it relishes flowing water, including on the streets and in botanical gardens. Plants can deal with poor drainage and thrive in medium to heavy soil conditions, but they may suffer from minor to mild damage from frost. Once it blooms, it requires fertilisation every year. It is more resilient to extended droughts in its earliest phases. While the plant responds to cutting, it cannot be used to cover up weeping characteristics. They can handle limited shade and bloom similarly compared to different bottlebrushes. However its scope is relatively constrained. A viable seed from a variety of callistemon can be produced, and if put down it will likely germinate quickly. Even while there is usually some variety in seedlings, no plant that grows from this germination will be an identical replica of the parent plant. Cuttings produce plants that are biologically similar to the parent plant. Due to an extended, elastic stalk, this kind of plant generates some of the most beautiful stamen in the group. During the blooming season, this flower, additionally referred to as Red *C. viminalis*, has stunning scarfer blooms. Additionally, *C. viminalis*, a plant that produces nectar, creates. massive amounts of nectar [4, 5, 6].

II. MORPHOLOGY

It is a moderate-sized tree with little branching and an erect crown that spreads widely.

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After 30 years, it is typical for mature trees to reach heights of 8 to 9 metres, though the majority of trees typically reach heights of 5 to 6 metres and widths of 8 to 9 metres. The three to four inch long, light green, thin leaves that only develop along the tips of the lengthy draping branches give the plant weeping aspect. The lanceolate leaves of *C. viminalis* measure 3 to 6 cm in width and 4 to 7 cm in length. Typically blooming in February, flowers on spines are around 14–15 cm long and contain prominent red stamens that are 15–25 cm long. The red, cylindrical, vivid reddish blossoms are made up of numerous, long filaments that resemble bristles. Which are normally one inch wide and three to five inches long. Small, insignificant flowers with pale or greenish flowers are present. Furthermore, while you are standing very close to the tree, the thorny capsules that follow the bloces are hidden [7, 8, 9].

MICROSCOPIC STUDY OF *Cllistemon viminalis*

Unomocytic stomata from the Myrtaceae family can be seen on the leaf. A cross section of the leaf also reveals the epidermis (dermis), cuticle (epidermis, periderm, and epidermal appendages), vascular handles (xylem and phloem), pericyclic fibres, collenchyma, and single-celled trichomes. the outermost layer of cork tissues, two to three layers of cortical tissue, seven to eight layers of medullary tissue, ray emissaries, endodermis, oil glands, sclerides in the cure area, and pith in the centre are all present within the stem [10, 11, 12].

The anomocytic cellular pores that are typical of the Myrtaceae family can be seen on the leaf surface. The cuticle, or outermost layer, bundles of vascular cells, fibres, single-cell trichomaids, collenchyma , accompany the layer of epidermis in the transverse area [17]. In the longitudinal part of the stem, one can see thelayer of epidermal,cork tissue's 2-3 layers,cortex tissue's 7-8 layers, the medullary rays, the endodermis,veins of xylem, glands of oil, sclerides in the stellar area, and pith atcore. The chemical components and compounds of leaves and stems went through a variety of histochemical reactions, and they were recently identified. When specific chemical reactions are carried out on various substrates, a particular colour is produced that is related to a particular metabolites [17–19]. For instance, lignin through the cortex produces yellow colour when exposed to aniline sulphate and sulfuric acid, while lignin from the xylem capillaries and medullary beams produces pink colour when treated with phloroglucinol and hydrochloric acid [22]. Whenever the cortex of the stach undergoes treatment with a mild iodine solution, the stach turns blue. When cortical volatile oil is exposed to sudan red II, it turns red [20]. White colour results from the reaction of pith proteins with Millon's reagent [20]. After reacting with sulphuric acid, calcium oxalate from the cortex produces kaleidoscope colour [17, 19, 20].

ESSENTIAL OIL CONSTITUENTS

A total of 42 important oil components, including alcohol, ester, aldehydes, acids, hydrocarbons,N-containing chemicals and ketone were isolated from leaves. The principal components are menthyl acetate, terpineol, pinene and 1,8-cineole while thujene, pinene, and myrcene are minor components. Pcymene, Terpinene, Terpinolene, Linalool, Transpinocarveol, Borneols, Humulene, Alloaromadendrene, Spathulenols, and Globulols [2] are some of the compounds in this mixture. There are many variations in the outcomes and characteristics of the oil components, that may be related along with the numerous environmental variables such as longitude, geographic location, etc., despite the fact that*C. viminalis* essential oil components has been carefully investigated in South Africa,Brazil, Australia, India, Cameroon and Egypt [21, 22]. Menthyl acetate, -pinene and 1,8-cineole being the three main components of oil extracted from the northern Indian the plains, although specimens from South Africa and Egypt exhibited a greater amount of 1,8-cineole compared to those from the Equator region, India, Cameroon, or Australia [10]. 1,8-Cineole had been identified as a reliable identifier and dominating constituent for the several Callistemon taxa and the Myrtaceae family in various geographic specimens [10].This plant's flowering tops are wealthy in alkaloids, phenols, tannins, amino acids, triterpenoids, saponins, protein,steroids, flavonoids, and carbohydrates. Chemicals such as these have been extracted from leaves of plants for about forty-two distinct chemical classes, encompassing acids, alcohols, aldehydes, esters, hydrocarbons, and ketones. This list consists of three major components: 18-cineole, a-pinene, and menthyl acetate, as well as each of their individual minor components: u-thujene, B-pinene, and myreene. The aromatics with the "ciruj" ending include (Peymene), (y terpinene), and (terpinolene). Linalool, Transpinocarveoli, Bomeol, Talloaromadendrene, Spachulenol, and Globulol [15, 16] are a few examples of compounds that have aromas. The leaves of the plant are utilised to create a distinctive flavour rather than tea. Longitude, geographical dispersion, and other environmental conditions have been suggested to play a role in the chemical makeup of

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essential oils of *Callistemon viminalis*. 18 cincole was discovered to have been the primary murker, also known as cineole, and predominator in the Callistemon gemas and the Myrtaceae family at various geographic areas [23, 24]. Following are a number of isolated compounds that have been obtained from multiple plant portions and that have been extracted through different herbal extracts Aerial Viminatione A and B (Tetra decahydro xanthene dianes derivative) such as apples, peaches, and walnuts. The literature from all over worldwide has demonstrated that the plant as a whole displays an extensive number of distinguished chemical combinations in all of its components (leaves, flower, fruits, wood, bark) [17, 18, 19].

PHYTOCONSTITUENTS OF DIFFERENT SPECIESOF GENUS CALLISTEMON

The Callistemon species was studied phytochemically, and numerous various categories of chemical compounds, namely derivatives of Phloroglucinol, Flavonoids, Essential oils, Sterols, and Triterpenes, were isolated. The information that is currently accessible in the scientific literature shows that there are not adequate investigations on the relationships between multiple species from a chemical compound and biological standpoint. The species of Callistemon known as C. citrinus and *C. viminalis* have undergone most extensive research. This book provides a thorough, current overview of the Callistemon genus' isolated active ingredients, their molecular makeup in various categories, and the biological consequences of various extracts [25]

ESSENTIAL OIL (TABLE-1)

S. No	COMPOUNDS	SPECIES	REFERENCE
1	1,8-Cineole	*C.viminalis, C.citrinus, C.rigidius*	26, 27, 28
2	Alpha-Pinene	*C.viminalis, C.citrinus, C.rigidius*	27, 28
3	Beta-Pinene	*C.viminalis, C.citrinus, C.rigidius*	28
4	Linaloole	*C.viminalis, C.citrinus*	27, 28
5	Limonen	*C.citrinus, C.rigidius*	27
6	Alpha-Terpineole	*C.viminalis, C.citrinus, C.rigidius*	29, 28
7	Gamma-Terpinene	*C.rigidius*	27
8	Alpha-Phellandren	*C.viminalis*	29
9	*p*-Cymene	*C.viminalis*	29
10	Menthyl Acetate	*C.viminalis*	29

STEROLS (TABLE-2)

S. No	COMPOUNDS	SPECIES	REFERENCE
1	Beta-Sitosterole	*C.citrinus, C.rigidus, C.linearis, C.viminalis*	30, 27, 29
2	Beta-Sitosterole-3-O-β-D-Glucoside	*C.citrinus, C.viminalis*	31, 29
3	Lupeole	*C.citrinus, C.viminalis*	27, 32, 29
4	Betulin	*C.citrinus, C.viminalis*	33, 30, 29
5	Betulinaldhyde	*C.citrinus*	34
6	Betulinic Acid	*C.citrinus, C.rigidus, C.linearis, C.viminalis, C.speciosus*	30, 35, 32, 29, 36, 27
7	3-epi Betulinic Acid	*C.citrinus*	37
8	Betulinic Acid 3-*O*-Caffeate	*C.citrinus*	38, 32
9	Alphitolic Acid	*C.citrinus*	32
10	30-Hydroxy Alphitolic Acid	*C.citrinus*	32

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TRITERPENES (TABLE-3)

S. No	COMPOUNDS	SPECIES	REFERENCE
1	Erythrodiol	*C.citrinus*	33, 30
2	Oleanolic acid	*C.citrinus, C.rigidus*	37, 33, 27
3	Arjunolic acid	*C.citrinus*	27
4	Hederagenine 3-O-β-glucopyranosyl-(1→2)-β-D-xylopyranoside	*C.viminalis*	39
5	Hederagenine-3-O-α-L-Arabinopyranoside	*C.viminalis*	39
6	Alpha-Amyrin	*C.citrinus, C.rigidus*	27
7	Urs-12-en-3β-ol-β-D-Glucopyranoside	*C.citrinus*	40
8	Uvaol	*C.citrinus*	27, 33
9	2α-Hydroxyuvaol	*C.citrinus*	41
10	Ursolic acid	*C.citrinus, C.speciosus, C.viminalis*	37, 33, 30, 27, 29
11	3-EpiUrsolic acid	*C.citrinus*	37
12	3-OAcetylursolic Acid 3-Epiacetate	*C.citrinus, C.viminalis*	40, 29
13	UrsolicAcid 3-*O*-Caffeat	*C.citrinus*	32
14	Corosolic acid	*C.citrinus, C.viminalis*	30, 26
15	2,3-Dihydroxyolean-12-en-28-oic Acid	*C.linearis*	36
16	Taraxerol	*C.citrinus*	31
17	3β-acetylmorolic Acid	*C.citrinus*	42, 32
18	MorolicAcid 3-*O*-Caffeat	*C.citrinus*	32
19	3β-Hydroxy-urs-11-en-13(28)-Olid	*C.citrinus*	42
20	Diospyrolid	*C.citrinus*	42

PHENOLIC DERIVATIVES (TABLE-4)

S. No	COMPOUNDS	SPECIES	REFERENCE
1	Catechol	*C.citrinus, C.rigidus*	27
2	Piceatannol	*C.citrinus, C.rigidus*	38, 43
3	Pyrogallol	*C.citrinus, C.rigidus*	27
4	ProtocatechuicAcid	*C.citrinus*	44
5	GallicAcid	*C.citrinus, C.viridiflorous, C.viminalis*	27, 45, 29
6	Methyl gallate	*C.citrinus, C.viminalis*	44, 29
7	1-O-Galloyl-β-D-glucopyranose	*C.viminalis*	27
8	ScirpusinB	*C.rigidus*	43
9	EllagicAcid	*C.citrinus, C.viridiflorous, C.viminalis, C.speciosus*	46, 27, 45, 29
10	3,3'-di-O-Methyl Ellagic Acid	*C.citrinus*	46
11	3,3',4-tri-O-Methyl Ellagic Acid	*C.citrinus*	46

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12	BlumenolA	*C.citrinus*	44
13	Nilocitine	*C.viridiflorous*	45
14	Casuarinine	*C.speciosus*	27
15	Castalagin	*C.viminalis*	39
16	2R,3R,4S,5S-2,4-bis(4-hydroxyphenyl)-3,5-dihydroxytetrahydropyran	*C.citrinus*	47
17	Isoguaiacin	*C.citrinus*	35
18	1,2,3,4,6-penta-O-galloyl-β-D-4-C1- glucopyranose	*C.citrinus*	48
19	Pterocaryanin	*C.citrinus*	48
20	GeminD	*C.citrinus*	48
21	GallicAcid4-O-(2,6-di-O-Galloyl)-beta-Dglucopyrano	*C.citrinus*	48

FLAVONOIDS (TABLE-5)

S. No	COMPOUNDS	SPECIES	REFERCENCES
1	Catechine	*C.citrinus, C.speciosus, C.viminalis*	38, 35, 27, 29
2	5,4'-Dihydroxy-6-C-Methoxy Flavanone	*C.coccineus*	27
3	5,4'-dihydroxy-8-C-methyl-7-methoxy flavanon	*C.coccineus*	27
4	5,4'-dihydroxy-6,8-dimethyl-7-methoxy flavanon	*C.citrinus, C.coccineus*	49, 27
5	5, 7, 3', 5'-tetrahydroxy-6, 8-di-C-methyl flavanone	*C.citrinus*	47
6	3'4'7-trihydroxy flavone	*C.citrinus, C.rigidus*	50
7	3'4'7-Trihydroxy Flavonol	*C.citrinus, C.rigidus*	50
8	Kaempferol	*C.citrinus*	27, 37
9	Quercetin	*C.citrinus, C.speciosus*	51, 27
10	3,8,4'-trimethoxy-6-methylaapigenin	*C.citrinus, C.coccineus*	27
11	CallistineA	*C.citrinus*	52
12	Syzalterin	*C.coccineus, C.citrinus*	27, 51
13	6,8-Dimethyl-4'-Methoxy Apigenin	*C.citrinus*	40
14	Sideroxylin	*C.citrinus*	51
15	Eucalyptin	*C.citrinus*	53, 54
16	8-De Methyl Eucalyptin	*C. citrinus*	35, 54
17	8-(2-hydroxypropan-2-yl)-5-hydroxy-7-methoxy-6-methyl-4′-methoxy flavone	*C. citrinus*	40
18	3'4'7-Trihydroxy flavone-7-*O*-β-D-Galactoside	*C.citrinus, C.rigidus*	50
19	3'4'7-Trihydrox flavonol-3-*O*-β-D-Glucoside	*C.citrinus, C.rigidus*	50
20	Isoquercetin	*C. viridiflorous*	45
21	Hyperin	*C.viridiflorous, C.viminalis*	45, 55

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22	Quercitrin	*C.viminalis*	55
23	Avicularin	*C.viminalis*	55
24	Quercetin 3-*O*-*alpha*-L-glucuronide	*C.speciosus, C.viridiflorous*	27, 45
25	Quercetin 3-*O*-beta-D-glucuronide	*C.viminalis*	55
26	Quercetin-3-*O*-(2”-O-galloyl)-beta-D-galactoopyranoside	*C.citrinus*	56
27	Quercetin-3-*O*-(2”-O-galloyl)-beta-D-glucuronopyranoside	*C.citrinus*	27
28	Astragalin	*C.citrinus*	52
29	Kaempferol-3-*O*-*beta*-D-galactopyranoside	*C.citrinus*	27
30	Kaempferol-3-*O*-*beta*-D-galacturonopyranoside	*C.citrinus*	57
31	Apigenin 4’-O-beta-D-Glucopyranosyl-(1‴ → 4″)-O-beta-D-Glucopyranoside	*C.viridiflorous*	45
32	Quercetin-(3‘-O-4“)-3“-omethyl-kaempfer	*C.viridiflorous*	58

ANTHOCYANINS (TABLE-6)

S. No	COMPOUNDS	SPECIES	REFERENCE
1	Cyanidine-3-glucoside	*C.phoeniceus*	56
2	Pelargonidin-3,5-diglucoside	*C.citrinus*	59
3	Cyanidine-3,5-diglucoside	*C.citrinus*	59

NEOLIGNANS (TABLE-7)

S. NO	COMPOUNDS	SPECIES	REFERENCE
1	CallislignanA	*C.citrinus*	60
2	CallislignanB	*C.citrinus*	60

PHLOROGLUCINOL DERIVATIVES (TABLE-8)

S. NO	COMPOUNDS	SPECIES	REFERENCE
1	CallistrilonesA	*C.rigidus*	61
2	CallistrilonesB	*C.rigidus*	61
3	CallistrilonesC	*C.rigidus*	62
4	CallistrilonesD	*C.rigidus*	62
5	CallistrilonesE	*C.rigidus, C.citrinus*	62, 35
6	CallistrilonesL	*C.citrinus*	35
7	CallistrilonesM	*C.citrinus*	35
8	CallistrilonesN	*C.citrinus*	35
9	CallistrilonesO	*C.citrinus*	33
10	CallistrilonesP	*C.citrinus*	33
11	CalliviminonesA	*C.viminalis, C.citrinus*	39, 63, 35
12	CalliviminonesB	*C.viminalis*	39, 63
13	CalliviminonesE	*C.viminalis*	39, 63
14	CalliviminonesF	*C.viminalis*	39, 63

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15	Calliviminones G	*C.viminalis*	39, 63
16	CalliviminonesH	*C.viminalis*	39, 63
17	CalliviminonesC	*C.viminalis*	39, 63
18	CalliviminonesD	*C.viminalis*	39, 63
19	CallistenonA	*C.citrinus*	34
20	MyrtucommuacetalonB	*C.rigidus*	62
21	MyrtucommulonA	*C.citrinus*	64
22	CallistenonB	*C.citrinus, C.saliginus*	42, 34, 65
23	MyrtucommulonB	*C.citrinus, C.saliginus*	42, 65
24	CallistenonC	*C.citrinus*	34
25	CallistenonD	*C.citrinus*	34, 35
26	CallistenonE	*C.citrinus*	34
27	CallistenonF	*C.viminalis*	66
28	CallisalignonC	*C.saliginus*	65
29	CallistenonG	*C.viminalis*	66
30	CallistenonO	*C.viminalis*	67
31	CallisalignonB	*C.saliginus*	65
32	CallistenonH	*C.viminalis, C.saliginus*	66, 65
33	CallistenonI	*C.viminalis*	66
34	CallistenonJ	*C.viminalis*	66
35	CallistenonK	*C.viminalis*	66
36	CallistemenononA	*C.viminalis*	68
37	CallistemonolA	*C.viminalis*	69
38	CallistemonolB	*C.viminalis*	69
39	CallisretoneA	*C.rigidus*	70
40	CallisretoneB	*C.rigidus*	70
41	CalliviminolA	*C.viminalis*	72
42	CalliviminolB	*C.viminalis*	72
43	CalliviminolC	*C.viminalis*	72
44	CalliviminolD	*C.viminalis*	72
45	CalliviminolE	*C.viminalis*	72
46	CallisalignenA	*C.saliginus*	65
47	CallisalignenB	*C.rigidus, C.saliginus*	70, 65
48	2-methyl-1- [(5aR,8R,9aR)-5a,8,9,9a-tetrahydro-3-hydroxy-1- methoxy-5a-methyl-8-(1-methylethyl)-4-dibenzofuranyl]-1- propanone	*C.rigidus*	70
49	CallisaligneneE	*C.saliginus*	65

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50	CallisaligneneF	*C.saliginus*	65
51	CallisaligneneG	*C.saliginus*	65
52	CallisaligneneH	*C.saliginus*	65
53	CallisaligneneI	*C.saliginus*	65
54	CallistivimenesA	*C.viminalis*	72
55	CallistivimenesB	*C.viminalis*	72
56	CallistivimenesC	*C.viminalis*	72
57	CallistivimenesD	*C.viminalis*	72
58	CallistivimenesE	*C.viminalis*	72
59	CallistivimenesF	*C.viminalis, C.citrinus*	72, 35
60	CallistivimenesG	*C.viminalis*	72
61	CallistivimenesH	*C.viminalis*	72
62	MyrtucommuloneL	*C.viminalis, C.citrinus*	72, 35
63	CallistivimenesI	*C.viminalis, C.citrinus*	72, 35
64	CallistivimenesJ	*C.viminalis*	72
65	CallistivimenesK	*C.viminalis*	72
66	CallistivimenesL	*C.viminalis*	72
67	CallistivimenesM	*C.viminalis, C.citrinus*	72, 35
68	CallistivimenesN	*C.viminalis, C.citrinus*	72, 35
69	CallistivimenesO	*C.viminalis*	72
70	ViminalinA	*C.viminalis*	73
71	ViminalinB	*C.rigidus, C.salignus, C.viminalis*	70, 74, 73
72	ViminalinC	*C.rigidus, C.viminalis*	70, 73
73	ViminalinD	*C.viminalis*	73
74	ViminalinE	*C.viminalis*	73
75	ViminalinF	*C.viminalis*	73
76	Viminalin G	*C.viminalis*	73
77	Viminalin H	*C.rigidus, C.viminalis*	70, 73
78	Viminalin I	*C.viminalis*	73
79	ViminalinJ	*C.viminalis*	73
80	Viminalin K	*C. viminalis*	73
81	ViminalinL	*C.rigidus, C.viminalis*	70, 73
82	ViminalinM	*C.viminalis*	73
83	ViminalinN	*C.rigidus, C.viminalis*	70, 73
84	ViminalinO	*C.viminalis*	73
85	ViminadionA	*C.viminalis*	75
86	ViminadionB	*C.viminalis*	75
87	GallomyrtucommulonA	*C.citrinus*	42
88	Gallomyrtucommulone E	*C.citrinus*	42
89	Gallomyrtucommulone F	*C.citrinus*	42

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90	PulverulentonA	*C.citrinus, C.viminalis, C.saliginus*	66, 65
91	2,6-Dihydroxy-4-methoxy-3-methylisopropiophenone	*C.viminalis, C.saliginus*	66, 65
92	Callisalignone A	*C.saliginus*	65
93	Asidinol D	*C.viminalis*	66
94	Asidinol A	*C.viminalis*	66
95	2,6-Dihydroxy-4-methoxyisovalerophenone	*C.citrinus, C.viminalis, C.saliginus*	42, 66, 65
96	1-(2,6-Dihydroxy-4-Methoxyphenyl)-3-Methylbutan-1-one	*C citrinus*	76
97	Flaveson	*C.citrinus*	34
98	Leptospermon	*C.citrinus*	34
99	Endoperoxide G3	*C.citrinus*	34
100	Rhodomyrtosone	*C.citrinus*	34
101	MyrtucommuloneD	*C.saliginus*	65
102	MyrtucommuloneK	*C.citrinus*	34

MISCELLANEOUS COMPOUNDS (TABLE-9)

S. No	COMPOUNDS	SPECIES	REFERENCE
1	Tetratriacontan-1-ol	*C.citrinus*	44
2	2,6,10-bisabolatrien	*C.citrinus*	44
3	Octacosanol	*C.viminalis*	29
4	n-HexadecanoicAcid	*C.viminalis*	29
5	HexahydrofarnesylAcetone	*C.viminalis*	29
6	Z-7-Tetradecenal	*C.viminalis*	39
7	(10E,12E)-Tetradecadienyl Acetate	*C.viminalis*	39
8	1,3-Cyclohexadien	*C.viminalis*	39
9	3-Methyltetradec-2-en-7-ol	*C.citrinus*	54
10	3,4-Dihydro-2-Hydroxymethyl-4-Methyl-2H-Pyrrol-2-ol		39, 26
11	2-Amino-2-Ethyl-Propane-1,3-Diyldioleate	*C.citrinus*	77
12	Nepetolide	*C.citrinus*	47
13	6,8-Dimethoxy-4,5-Dimethyl-3-Methyleneisochroman-1-on	*C.citrinus*	47
14	3-methyl-7-O-Benzoyl-β-D-Glucopyranosid	*C.citrinus*	47

DIFFERENT SPECIES OF CALLISTEMON AND THEIR CHARACTERSTICS:

Crimson Bottlebrush (*Callistemon citrinus*)	The lemon bottlebrush and the red bottlebrush are other names for it. It's regarded as the king of the bottlebrush family because of its magnificent crimson blossoms. The citrinus is a well-liked option because of its broad arching canopy.

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Albany Bottlebrush (*Callistemon glaucus*)	The glaucus cultivars produces a fantastically dense canopy that makes it ideal for screening. It is extremely robust and suitable for a wide range of soils and environments, calling by the alternate name of Albany bottlebrush. But most crucially, for the flowers to bloom, the sun must be fully exposed.
Prickly Bottlebrush (*Callistemonbrachyandrus*)	The brachyandrus plant variety, often known as the prickly bottlebrush, develops odd yellow antlers that extend out of the red blossom. This plant variety, which is particularly appropriate for Australia's East Coast, is exceptionally tolerant to excessively soils that are wet and climates that are humid. An crucial component of this plant maintenance is trimming.
Lesser Bottlebrush (*Callistemon phoeniceus*)	The phoeniceus is a cheerful and lovely variation of the bottlebrush family that is attractive in pink. Likewise called the Scarlet bottlebrush, the fiery bottlebrush, or the smaller bottlebrush. Shorter blooming than other shurbs, it thrives in cooler climates.
Weeping Bottlebrush (*Callistemon viminalis*)	One of the numerous bottlebrush species that grows the quickest is the weeping bottlebrush, or Callistemon Captain Cook. It is an extremely robust grower, frequently growing up to 5 metres tall.
Kingaroy Bottlebrush (*Callistemon formosus*)	The formosus or Kingaroy bottlebrush represents a fantastic, weeping cultivar having gorgeous lemon coloured blossoms that are ideal for additional tropical regions.
Alpine Bottlebrush (*Callistemon pityoides*)	The alpine bottlebrush is another yellow-bloomer with a slightly resilient growing habit, making it suitable for smaller areas.

PHARMACOLOGICAL APPLICATIONS OF *CALLISTEMON VIMINALIS*

ANTIBACTERIAL ACTIVITY

The In-vitro Bactericidal Activity of the oils (essential) (*C.citrimes* and *C.viminalis*) has been determined usingbroth microdilution and disk diffusionEven though they were efficient towards certain bacteria, the prsents a potent inhibition zonetowards S. faecalis, both S. aureus strains, B. cereus, and S. macrcesens. Staphylococcus macruri and Pseudomonas seraginosa aeruginosa should be anticipated. Certain *C. viminalis* extracts are effective against bacteria along with certain strains of bacteria.S. aureus, Streptococcus pneumonia, Staphylococcus epidermidis, and Klebsilla pneumonia were all sensitive to the MeOH extract, whereas S. aureus was notably active towards methicillin-resistant S. aureus. Aqueous and alcoholic extracts of the leaves are capable of being mixed with Kiebrietla oxytaci, Proteus vulgaricas, and E. coli; however, extract of aqueous seems more efficient thanextract of ethanol. The capacity of the essential oil from C. viminalls to stop the growth of S. aureus and E. coli bacteria was determined. Ecoli, however, was very sensitive to the essential oil. S. aureux didn't seem to be significantly impacted. Moderate to excellent antibacterial activity is shown in methanol leaf extract [78, 79].When examined for its capacity to inhibit this human pathogen, *C. viminalis* aqueous extract reduced toxins production by 50–90% and mortality by 60%, highlighting the potential for the production of anti-infectives [29]. Having Minimum Inhibitory Concentrations and Minimum Bactericidal Concentrations encompassing from 5 to 80 g/ml, Callistemenonone A obtained from the *C. viminalis*' leaves demonstrated powerful activity of antibacterial towards Gram +ve bacteria; due to its relative inability it was still inactive towards gram-ve bacteria to cross the the permeability hurdle caused due to the external membranes and the behaviour transporters of efflux [68]. Callistemonols A and B are additionally known to have powerful antibacterial properties towardsMethicillin-Resistant strain of S. aureus, with Minimum Inhibitory Concentrations and/orMinimium Bactericidal Concentrations varying between 1.56 to 6.25 g/ml if applied with a conventional Minimum Inhibitory Concentrations technique. Additionally, they exhibited little activity towards the bacterium E. coli i.e Gram-ve [69].

ANTIFUNGAL ACTIVITY

The primary constituents found in the oil (essential) of *C. viminalis* include 1, 8-cineole and alpha-pinene and terpinen-4-ol, which have been

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shown to have the strongest antifungal effects towards plant-borne fungal infections like Fusarium oxysporum, Fusarium solani, alternaria alternate and Botrytis cinerea among other fungi [80]. The effectiveness of *C. viminalis* extracts in aqueous, methanol and hexane form against the Candida albicans fungus was evaluated. Aqueous,hexane and methanol extract of C.viminalis has been investigated shown to exhibit MIC values that are 3.2 mg/mL, 1.6 mg/mL, and 3.2 mg/mL, respectfully. Maximum extract from plants exhibited antifungals properties, but/and thefraction of shown more properties of antifungal than the comparable hexane and aqueous-based extracts [81]. Candida albicans was subjected to properties of antifungal of *C. viminalis*' crude extracts and essential oil [82]. A. niger fungal strain was examined using essential oil extracted from fresh *C. viminalis* leaves, and the results indicated moderate activity levels [83].The crude extracts obtained from the aerial parts of *C. viminalis* exhibited strong potential toward C. albicans and C. kefyr, aslo both Gram +ve and Gram-ve bacteria [84]. The alkaloids extracted from *C. viminalis* showed higher inhibitory effects against O. limnetica and A. cylindrical, with increasing effectiveness observed at higher concentrations [85]. The methanol extract, which contained steroids, terpenoid, flavonoid, tannin, and alkaloid, displayed activity towards E.coli, S.aureus, A.niger, and Candida albicans [86].

ANTI-QUORUM ACTIVITY

The leaves of *C. viminalis* have been found to contain aqueous and ethanol extracts that exhibit activity of anti-quorum sensing which can help regulating the pathogenic behavior towards various bacterial organism. This activity was demonstrated using two biomonitor strains, C. violaceum and A. tumefaciens, and it resulted in the inhibition of genes ofQuorum Sensing (QS) (las and rhl) as well as factors of QS-controlled[39, 87].

Quorum sensing (a bacterial cell-to-cell communication mechanism) are known to exhibit a crucial part in regulating the pathogenicity towars various bacteria. Leaf extract of *C. viminalis* has been demonstrated to retainactivity of AQ sensing in 2 bio-monitor strains, C. violaceum and A. tumefaciens. This activity was observed through the inhibition of quorum sensing genes and QS-controlled factors [88, 89].

ANTI-PLATELET AGGREGATION

In an in vitro study, rat platelet aggregation was induced using Epinephrine, Adenosine Diphosphate (ADP), and Thrombin. The Anti-platelet aggregation activity of four compounds isolated from *C. viminalis* leaves, namely OleanolicAcid, UrsolicAcid, BetulinicAcid , and MaslinicAcid, was evaluated. The compounds were tested for their effects on thrombin-induced aggregation of platelet, as well asepinephrine and ADP-induced platelet aggregation. Results showed that among the compounds, OA exhibited the greatest activity with an IC50 value of 0.84 mg/ml. Additionally,combination of BA and OA (BAOA) exhibited the highest degree of activity with an IC50 value of 261 mg/ml. Notably, previous reports have indicated that a concentration of 2.57 mg/mL of BAOA had a significant consequences on epinephrine-induced aggregation of platelets [90].

ALLELOPATHIC ACTIVITY

Allelopathy is a significant phenomenon whereby certain biochemical substances influence the other organisms growth. In a recent study, it was discovered that the oils (essential) derived from the *C. viminalis*'s flower exhibited allelopathic activity. The intensity of this activity was found to beproportional to the concentrations of the oil (essential)directly which ranged from 0.2 to 5.0 μLmL−1. The study specifically measured the impact of these concentrations on the Germination Speed Index (GSI) seeds of lettucesas well as length and mass of dry shoot and root in lettuce seedlings lettuce. Observed data indicated that the growth of lettuce seedlings, including shoot and/or root development, was completely inhibited at a concentration of 5.0 μLmL−1 [91, 92].

ANTI-HELMINTHIC ACTION

Pheretima posthuma and Taenia softum Linn. Demonstrated effective anthelmintic action in Vitro, whereas the activitiestowardsHookworms (Bunostom trigonocephalum were equal to that of hexylresorcinol [92]. In vitro studies have demonstrated the effective anthelmintic action of P. posthuma and T. solium Linn. Furthermore, the anthelmintic activitiestowardsHookworms (B. trigonocephalum)found to be equivalent to that of hexylresorcinol [92]. Similarly, the essential oils derived from *C. viminalis* exhibited notable anthelmintic activity in vitro. These oils displayed greater potential towardsEarthworm (P.posthuma) and tapeworm (T.solium Linn.) compared to Piperazine Phosphate. Moreover, their activity against hookworm (B.trigonocephalum) was compared to hexylresorcinol [93-95]. Theoils (essential) of C.viminalis has been reported to

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possess anti-helminthic properties, particularly exhibiting enhanced efficacy in vitro against earthworms and tapeworms when compared to piperazine phosphate [93].

ANTI-INFECTIVE

A study investigated the potential anti-infective properties of aqueous extracts from three plant species: *C. viminalis*, *Conozerectus*, and *Bucida buceras*. The researchers present these extracts for their ability to inhibit thehuman pathogen P. aeruginosa. The results indicated that extracts caused a significant reduction in toxin production, which are range from 50% to 90%, and a rate of molarity of 60%. These findings suggest that these plant extracts have promising potential for the development of anti-infective treatments [96-98].

TOXICITY OF MOLLUSKS

The LC50 value, which represents the concentration at which 50% of the snails were killed, was determined to be 6.2 ppm for the bark, fruits, and leaves of *C. viminalis*. However, oil (essential) extracted by the leaves had a highest LC50 value of 32 ppm, indicating a relatively lower molluscicidal potency. Among the tested fruit extracts, the fruits of *C. viminalis* extract exhibit the strongest impact towards the snails, approximately ten times stronger than the other fruit extracts. Histopathological investigations revealed that the target location for all the tested extracts was the hermaphrodite gland.In summary, *C. viminalis* extracts, particularly those from the bark, fruits, and leaves, demonstrated antiparasitic efficacy against the intermediate host snails responsible for transmitting schistosomiasis. The extracts disrupted the fatty acid profile of the snails, effectively killing them. Theextract of fruits exhibited the molluscicidal activity in highest potential, while theoil (essential) extracted from the leaves had a relatively lower potency. The hermaphrodite gland was identified as the targeted location for all tested extracts based on histopathological investigations.The passage describes a study that tested the molluscicidal activities of *C. viminalis*'s crude extract on the intermediate host Biomphalaria alexandrina snails, which are responsible for transmitting human schistosomiasis. The study revealed that powder of methanolic crude extracts ofleaves, bark, and fruit os *C. viminalis* showed molluscicidal activity against the snails, with C.viminalis fruits extract showing highest effects.Overall, the study suggests that *C. viminalis* extracts could be used as a potential tool to control the transmission of schistosomiasis by targeting the intermediate host snails [10].

ACTIVITY OF INSECTS

C. viminalis exhibited moderate efficacy in eradicating stored-grain insects, specifically targeting pests such as Sitophilus oryzae, Tribolium castaneum, and Rhyzopertha dominica. Research indicates that essential oils derived from *C. viminalis* possess toxicity towards Ephestia kuehniella and impede the functioning of its immunological cells at a manner of concentration-dependent. Treated larvae exhibited a reduce inoverall hemocyte count over time following exposure to *C. viminalis* oils.Furthermore, the oils (essential) from *Callistemon viminalis* were employed as a fumigants towards the entomopathogenic nematodes Sinophiles oryzae, Acanthoscelides obtectus, and Callosobruchus maculatus. When dried leaves containing the highest concentration (0.40 mL/g) or discs of filter paper (0.251 ml/cm2) infused with these oils were applied to the grains, a mortality rate of 72.6% and 80% was observed for the aforementioned insects, which are commonly found as pests in stored beans in Cameroon. However, no significant effect on the insects was observed when powder and acetone extracts were tested at the given concentrations [99].A study was conducted to investigate the insecticidal properties ofoils (essential)obtained from the *C. viminalis*'s leaves and flowers against M. aphid. Results showed that the utility of oil (essential) extracted from the flowers at a concentration of 0.5% had an impact on the preference of aphids and their ability to reproduce. The present of oil (essential) from the leaves resulted in a decrease in the number of adult aphids within 48 hours. Both essential oils caused a reduction in number of average of adult aphids within 48 hours, with no discernible preference observed. These findings suggest that oils (essential)derived from theof C.viminalis's leaves and flower may have potential as an insecticide against Myzuspersicae aphid [97].Two new epimeric compounds, Viminadione Aand Viminadione B, has been discovered in upper part of *Callistemon viminalis*. These compound has demonstrated properties of insecticidal. The LD50 values were determined by applying microdroplets of acetone solutions containing different concentrations of the compounds topically to groups of insects. Each concentration was tested on two separate batches of insects, with 10 to 15 insects per batch. The

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mortality rate was then assessed after either 24 or 48 hours. For compound (VA), the LD50 for houseflies (Musca domestica) was found to be 1.9 µg per insect. The LD50 for aphids (Aphis fabae) was determined to be 5.9 µg per insect, while for thrips (Thrips tabaci) it was 4.2 µg per insect. On the other hand, compound (VB) exhibited lower activity, with only 60% mortality observed inat a dose of 10 µg in houseflies. To provide a basis of comparison, the LD50 values for pyrethrum extract, a well-establishedinsecticide (botanical), were also mentioned. The LD50 values for extract of pyrethrum are 0.01, 3.8, and 7.9 µg per insect for houseflies, aphids, and thrips, respectively [75, 100].

ANTIOXIDANT ACTIVITY

According to a study, the oil (essential) derived from the *Callistemon viminalis* plant showed the antioxidant at higher potential, with a percentage of 88.60±1.51%, surpassing even the standardgallic acid compound i.e. antioxidant, which showed a percentage of 80.00±2.12%. Additionally,the C.viminalis's ethyl acetate leaf extract plant demonstrated antioxidant activity similar to gallic acid, with a percentage of 85.12±1.42% [5]. Another study found that the*C. viminalis* leaves's petroleum extract exhibited a excellent IC50 value of 56.2 ± 0.54 µg/ml compared to Butylated Hydroxy Toluene compounda standard antioxidant. Moreover, the total extracts, including the fruits and bark's PetroleumEther, MethyleneChloride, and EthylAcetate fraction of C.viminalis, along with the compounds MethylGallate, GallicAcid, Catechine, and ElagicAcid, exhibited high activity of antioxidantwhichwas compare tothe ascorbic acid a standard antioxidant [101].

HEMOLYTIC ACTIVITY

The study investigated theactivity of hemolytic of extract of *C. viminalis*onerythrocytes of human blood and found that the % of RBC lysis ranged from 1.95% to 6.33%. This suggests that the extracts may have potential therapeutic applications. The leaves's methanolic extract was found to cause hemolysis within the range of 1.79% to 4.95%. The sequence of the hemolysis percentage of different extract was chloroform > ethyl acetate > 90% methanol > 95% methanol > absolute methanol > petroleum ether > n-butanol.Furthermore,study examined the alcoholic extract of *C. viminalis*effect on the profile of renal of rabbits infect with S. pneumonia. The results showed significant variations in the levels of creatinine kinase, and uric acid, creatine,blood urea nitrogen [39, 102, 103].

LARVICIDAL ACTIVITY

Larvicidal activityof C. rigidus's leaf extract was examined by follows the standard procedure recommended by the WHO. Theplant extracts and fractions toxicity against three species of mosquito larvae, namely Anopheles gambiae, Aedes aegypti, and Culex quinquefasciatus, was determined. The hexane fraction of C.rigidus demonstrated the highest activity against Ae. aegypti, with a median lethal concentration (LC50) of 56.25 parts per million (ppm). Against An. gambiae, the hexane fraction showed potential as a mosquito larvicide, as it killed almost maximum larvae showed at all concentrations tested, with an LC50 of 17.11 ppm. Regarding Cx. quinquefasciatus, onlyfraction and crude extracts of Hexane and Methanol displayed activities of larvicidal, with LC50 values of 447.38 Ppm and 721.95 Ppm, accordingly. These outcomes indicate that C. rigidus has highest lactivity of larvicidaltoward clinically importanat mosquito vectors [104].Similarly, the *C. viminalis*'s extract were examined for their larvicidal activity. Theextract of isopropanol was particularly potential A. albopictus larvae, with an LC50of 71.34 Ppm. Furthermore, at a concentration of 50 ppm, it exhibited slight attractancy, resulting in nearly a twofold increase in egg deposition in treated bowls. The fruit, bark, and leaf extracts obtained using methanol displayed LC50 values of 6.2 Ppm, 32 Ppm, and 40 Ppm, accordingly, towards Biomphalaria alexandrina snails, which are vectors of schistosomiasis [105].

ANTIDIARRHEAL ACTIVITY

In a study, the researchers examined the antidiarrheal properties of the methanol extract obtained from C. citrinus. They conducted the experiment using mice and induced diarrhea using castor oil. Extract was orally given to the mice at two different doses: body weight of 200mg/kg andbody weight of 400mg/kg. The researchers found the number of defecations in each mouse as an indicator of the antidiarrheal activity.The outcomes of the studies revealed oral administration of methanol extract from C.citrinus significantly exhibited antidiarrheal effects. Both extract's doses , 200 mg/kg and 400 mg/kg, demonstrated a marked inhibition of 78% after 3 hours of administration [106].

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ANALGESICA

In this case, the analgesic activities of C.citrinus's metanolic extract was evaluated in Swiss-Albino Mice. The analgesic effect of C.citrinus were evaluated using the method of acetic acid-induced method and the tail immersion method. Oral administration of the methanol extracts at doses of 200 and 400 mg/kg significantly decreases number of writhings by 44.07% and 55.96% respectively. The extract also increased the Tail Flicking Latency period to 9.17 and 11.39 after 90 minutes. These findings indicate that the methanol extracts of C.citrinus leaves has potential analgesic properties [106].

ANTI-INFLAMMATORY ACTIVITY

C. citrinus leaf extracts were tested for their anti-inflammatory activity by measuring their ability to inhibit albumin denaturation. The chloroform, ethanol, and aqueous extracts exhibited IC50 values of 388.322 µg/mL, 277.10 µg/mL, and 250.85 µg/mL, accordingly. In comparison, diclofenac sodium has an IC50 values of 476.24 µg/mL. The results indicate that the aqueous extract demonstrates stronger anti-inflammatory activity against protein denaturation compared to the chloroform extract and diclofenac sodium, possibly due to the presence of terpenoids and flavonoids [107]

III. CONCLUSION

WHO estimates that 80% of people worldwide, typically those who live in developing countries, rely on pharmacological therapies made from plants for their health care. It's been found that around 60% of medications approved for treating acute illnesses come from plants. Because they have fewer side effects, natural drug treatments are gaining popularity on a global scale. As a result, modern drugs are being used for treating a broad range of acute afflictions. Numerous tests along with academic investigations have established that *C. viminalis* is a significant medicinal plant with historical significance. There are still a lot of pharmacological applications that need to be investigated, even if biological and medical uses had been investigated. The majority of studies utilising plant extracts indicated AntioxidantActivities, InsecticidalActivities, MoluscicidalActivities, AntibacterialActivities, AntifungalActivities, AllelopathicActivities, Anti-platelet AggregationActivities, Anti-quorum Sensing activity, AntihelminthicActivity andactivities of Anti-infective; however, active principle connected behind these properties needs to be investigated.

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