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Clerodendrum and Heathcare: An Overview

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ABSTRACT

The genus *Clerodendrum* L. (Family: Lamiaceae) is very widely distributed in tropical and subtropical regions of the world. More than five hundred species of the genus are identified till now, which includes small trees, shrubs and herbs. Ethno-medical importance of various species of *Clerodendrum* genus has been reported in various indigenous systems of medicines and as folk medicines. The genus is being used as medicines specifically in Indian, Chinese, Thai, Korean, Japanese systems of medicine for the treatment of various life-threatening diseases such as syphilis, typhoid, cancer, jaundice and hypertension. Few species of the genus like *Clerodendrum inerme*, *C. thomosonae*, *C. indicum*, and *C. speciosum* are ornamental and being cultivated for aesthetic purposes. The powder/paste form and the various extracts of root, stem and leaves are reported to be used as medicine for the treatment of asthma, pyreticosis, cataract, malaria, and diseases of blood, skin and lung. To prove these ethno-medical claims, some of these species are being extensively studied for their biological activities using various animal models. Along with biological studies, isolation and identification studies of chemical constituents and its correlation with the biological activities of the genus has also been studied. The major chemical components reported from the genus are phenolics, steroids, di- and triterpenes, flavonoids, volatile oils, etc. This review mainly covers the extent of work done on biological activities of various *Clerodendrum* species such as *C. trichotomum*, *C. bungei*, *C. chinense*, *C. colebrookianum*, *C. inerme*, *C. phlomidis*, *C. petasites*, *C. grayi*, *C. indicum*, *C. serratum*, *C. campbellii*, *C. calamitosum* and *C. cyrtophyllum* that can be used both in conventional therapy or as replacement therapies for the treatment of various diseases.

Keywords: ethnomedical, phytochemistry, anti-inflammatory, antimicrobial, antimalarial, antioxidant, antidiabetic, polyphyletic, paraphyletic

Abbreviations: **AGC**, apigenin-7-O-*β*-D-glucoside; **GSH**, glutathione; **MDA**, malondialdehyde; **PGE2**, prostaglandin E2; **XO**, xanthine oxidase

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INTRODUCTION

The genus *Clerodendrum* L. [Family Lamiaceae (Verbenaceae)] is very widely distributed in tropical and subtropical regions of the world and is comprised of small trees, shrubs and herbs. The first description of the genus was given by Linnaeus in 1753, with identification of *C. infortunatum*. After a decade later in 1763 Adanson changed the Latin name "*Clerodendrum*" to its Greek form "*Clerodendron*"; in Greek *Klero* means chance and *dendron* means tree i.e. chance tree which means the tree which does not bring good luck like *Clerodendron infortunatum* or the tree which brings good luck like *C. fortunatum*. Later on after a span of about two centuries in 1942 Moldenke readopted the Latinized name '*Clerodendrum*', which is now commonly used by taxonomists for the classification and description of the genus and species (Moldenke 1985; Rueda 1993; Hsiao and Lin 1995; Steane *et al*. 1999). *Clerodendrum* is a very large and diverse genus and till now five hundred and eighty species of the genus have been identified and are widely distributed in Asia, Australia, Africa and America (**Table 1**). A high degree of morphological and cytological variation (from 2n=24 to 2n=184) amongst the species, suggesting the paraphyletic or polyphyletic origin of the genus. Molecular systematic studies based on cloroplast and nuclear DNA also indicate polyphyletic origin of the genus (Steane *et al*. 1999). Owing to morphological variations like length of the corolla tube, size of leaves, and type of inflorescence some authors have classified the genus into two major subgenera, *Clerodendrum* and *Cyclonema* (Steane *et al*. 1999) while others have classified it into five subgenera and each subgenus is again subdivided into many sections (Moldenke 1985). Similarly many species of the genus have been described by more than one author and hence are denoted in the literature with the name of different authors e.g. *C. floribundum* Hort. and *C. floribundum* R.Br., *C. foetidum* Bunge

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Invited Review

Table 1 List of various species from the genus *Clerodendrum*. * Species described by more than one author.

C. acerbiana Benth. & Hook.f.	*C. cernuum* Wall.ex Steud.	*C. foetidum* Bunge*	*C. kampotense* Dop
C. aculeatum (L.) Schlecht.*	*C. chamaeriphes* Wernham	*C. formicarum* Gurke	*C. kanichi* Wildem.
C. acuminatum Wall.	*C. citrinum* Ridley	*C. formosanum* Maxim.	*C. katangensis* Wildem.
C. adenocalyx Dop	*C. coccineum* D.Dietr.*	*C. fortunatum* Buch.-Ham.ex Wall.*	*C. kentrocaule* Baker
C. adenophysum H.Hallier	*C. cochinchinense* Dop	*C. fortunei* Hemsl.	*C. kinabaluense* Stapf
C. affine Griff.	*C. colebrookianum* Walp.	*C. fragrans* Vent.*	*C. kirkii* Baker
C. africanum Moldenke	*C. commersonii* Spreng.	*C. francavilleanum* Buchinger ex	*C. kissakense* Guerke
C. aggregatum Gurke	*C. condensatum* Miq.	Berthold Thomas	*C. klemmei* Elmer
C. alatum Gurke	*C. confusum* H.Hallier	*C. friesii* K.Schum.	*C. koshunense* Hayata
C. albiflos H.J.Lam	*C. congense* Baker*	*C. f.rutectorum* S.Moore	*C. kwangtungense* Hand.-Mazz.
C. amicorum Seem.	*C. congestum* Guerke	*C. fugitans* Wernham	*C. laciniatum* Balf.f.
C. amplifolium S.Moore	*C. conglobatum* Baker	*C. fuscum* Gurke.	*C. laevifolium* Blume
C. amplius Hance	*C. consors* S.Moore	*C. galeatum* Balf.f.	*C. lanceolatum* F.Muell.
C. anafense Britton & P.Wils.	*C. corbisieri* De Wild.	*C. garrettianum* Craib	*C. lanceolatum* Gurke.
C. angolense Guerke	*C. cordatum* D.Don	*C. gaudichaudii* Dop	*C. lanceoliferum* S.Moore
C. angustifolium Salisb.*	*C. cordifolium* A.Rich.	*C. geoffrayi* Dop	*C. lanessanii* Dop
C. apayaoense Quisumb.	*C. coriaceum* Poir.*	*C. giletii* Wildem. & Th.Dur.	*C. lankawiense* King & Gamble
C. arenarium Baker	*C. coromandelianum* Spreng.	*C. glaberrimum* Hayata	*C. lanuginosum* Blume
C. arthur-gordoni Horne ex Baker	*C. costaricense* Standley	*C. glabratum* Guerke	*C. lasiocephalum* C.B.Clarke
C. assurgens K.Schum.	*C. costatum* R.Br.	*C. glabrum* E.Mey.	*C. laxicymosum* De Wild.
C. attenuatum De Wild.*	*C. costulatum* K.Schum.	*C. glandulosum* Colebr.ex Wall.	*C. laxiflorum* Baker
C. aucubifolium Hemsl.	*C. cruentum* Lindl.	*C. glandulosum* Lindl.	*C. lecomtei* Dop
C. aurantiacum Baker	*C. cubensis* Schau.	*C. glaucum* Wall.ex Steud.	*C. lehuntei* Horne ex Baker
C. aurantium G.Don	*C. culinare* Sesse & Moc.	*C. globuliflorum* Berthold Thomas	*C. lelyi* Hutchinson
C. × speciosum Teijsm. & Binn.	*C. cumingianum* Schau.	*C. godefroyi* Kuntze	*C. leucophloeum* Balf.f.
C. bakeri Gurke	*C. cuneatum* Guerke*	*C. goossensi* De Wild.	*C. leucosceptrum* D.Don
C. balfouri Hort.	*C. cuneifolium* Baker	*C. gordoni* Baker	*C. leveillei* Fedde ex Leveille
C. barbafelis H.Hallier	*C. cunninghamii* Benth.	*C. gossweileri* Exell	*C. ligustrinum*
C. baronianum Oliver	*C. curranii* Elmer	*C. grandicalyx* E.A.Bruce	*C. lindawianum* Lauterb.
C. barteri Baker	*C. curtisii* N.E.Br.	*C. grandiflorum* Schau.	*C. lindemuthianum* Vatke
C. baumii Guerke	*C. cuspidatum* Turcz.	*C. grandifolium* Gurke*	*C. lindenianum* A.Eich.
C. bequaerti De Wild	*C. cyrtophyllum* Turcz	*C. gratum* Kurz*	*C. lindleyi* Decne.ex Planch.
C. bernieri Briq.	*C. darrisii* Leveille	*C. greyi* Baker	*C. linnaei* F.Muell.*
C. bethuneanum Low	*C. deflexum* Wall.	*C. griffithianum* C.B.Clarke	*C. lividum* Lindl.
C. bingaense S.Moore	*C. dekindtii* Guerke	*C. guerkii* Baker	*C. lloydianum* Craib
C. bipindense Guerke	*C. dembianense* Chiov.	*C. haematocalyx* Hance	*C. lobbii* C.B.Clarke
C. blancoanum Villar	*C. densiflorum* Griff.	*C. haematolasium* H.Hallier	*C. longicolle* G.F.W.Mey.
C. blancoi Naves ex Villar	*C. dentatum* Wall.	*C. hahnianum* Dop	*C. longiflorum* Decne.
C. blumeanum Schau.	*C. depauperatum* Wall.ex Steud.	*C. hainanense* Hand.-Mazz.	*C. longilimbum* P'ei
C. bodinierii Leveille	*C. dependens* Aug.DC.	*C. harmandianum* Dop	*C. longipetiolatum* Gurke*
C. bolivianum Rusby	*C. dicolor* Vatke	*C. harnierianum* Schweinf.	*C. longisepalum* Dop
C. botryoides Baker	*C. diepenhorstii* Miq.	*C. hastato-oblongum* C.B.Clarke	*C. longituba* Valeton
C. botryoides K.Schum.	*C. dinklagei* Gurke	*C. hastatum* Lindl.	*C. longitubum* Wildem. & Th.Dur.
C. brachyanthum Schau.	*C. discolor* Becc.	*C. helianthemifolium* Wall.ex Steud.	*C. luembense* De Wild.
C. brachypus Urb.	*C. disparifolium* Blume	*C. hemiderma* F.Muell.ex Benth.	*C. lujaei* Wildem. & Th.Dur.
C. lerodendrum bracteatum Wall.	*C. divar. catum* Jack*	*C. henryi* P'ei	*C. lupakense* S.Moore
C. bracteosum Kostel.	*C. diversifolium* Vahl	*C. herbaceum* Wall.	*C. luzoniense* Merrill
C. brassii Beer & H.J.Lam	*C. dubium* De Wild.	*C. heterophyllum*	*C. mabesae* Merrill
C. brazzavillense A.Cheval.	*C. duckei* Moldenke	*C. hettae* H.Hallier	*C. macradenium* Miq.
C. breviflorum Ridl.	*C. dumale* Baker	*C. hexagonum* De Wild	*C. macrocalycinum* Baker
C. brookeanum W.W.Smith	*C. dumale* K.Schum.	*C. hexangulatum* Berthold Thomas	*C. macrocalyx* De Wild.*
C. brunfelsiiflorum H.Hallier	*C. dusenii* Guerke	*C. hildebrandtii* Vatke	*C. macrophyllum* Blume*
C. brunsvigioides Baker	*C. eketense* Wernham	*C. hircinum* Schau.	*C. macrosiphon* Hook.f.*
C. buchananii Herb.Roxb.ex Wall.	*C. ekmani* Moldenke	*C. hirsutum* G.Don*	*C. macrostachyum* Baker*
C. buchholzii Gurke	*C. elberti* H.Hallier	*C. hispidum* M.R.Henderson	*C. macrostegium* Schau.
C. buchneri Gurke	*C. elegans* Manetti ex Lem.	*C. hockii* De Wild.	*C. madaeera* Voigt
C. buettneri Gurke	*C. ellipticum* Zipp.ex Span.	*C. holstii* Guerke ex Baker*	*C. magnificum* Warb.
C. bukobense Gurke	*C. elliptifolium* Merrill	*C. holtzei* F.Muell.	*C. magnoliaefolium* Baker
C. bungei Steud.	*C. elmeri* Merrill	*C. horsfieldii* Miq.	*C. makanjanum* H.Winkler
C. buruanum Miq.	*C. emarginatum* Briq.	*C. huegelii* Hort.ex Regel	*C. mandarinorum* Diels
C. buxifolium Spreng.	*C. emirnense* Boj.ex Hook.	*C. humile* Chiov.	*C. manetti* Vis.
C. cabrae De Wild.	*C. epiphyticum* Standley	*C. hysteranthum* Baker	*C. mannii* Baker
C. caeruleum N.E.Br.	*C. erectum* De Wild.	*C. illustre* N.E.Br.	*C. margaritense* Moldenke
C. caesium Guerke	*C. eriophyllum* Gurke	*C. impensum* Berthold Thomas	*C. matudae* Standley
C. calamistratum Hort.Belg.ex Lem.	*C. eriosiphon* Schau.	*C. imperialis* Carr.	*C. medium* R.Br.
C. calamitosum Linn.	*C. esquirolii* Leveille*	*C. inaequipetiolatum* Good	*C. megasepalum* Baker
C. calcicola Britton	*C. eucalycinum* Oliver	*C. incisum* Klotzsch	*C. melanocrater* Gurke
C. calycinum Turcz.	*C. eupatorioides* Baker	*C. indeniense* A.Cheval.	*C. membranifolium* H.J.Lam
C. camagueyense Britton & P.Wils.	*C. euryphyllum* Mildbr.	*C. indicum* Druce*	*C. mexicanum* T.S.Brandegee
C. canescens Wall.	*C. excavatum* De Wild.	*C. inerme* Gaertn.*	*C. meyeri-johannis* Mildbraed
C. capense D.Don ex Steud.*	*C. fallax* Lindl.	*C. infortunatum* Dennst.*	*C. micans* Gurke
C. capitatum Hook.*	*C. fargesii* Dode	*C. ingratum* K.Schum. & Lauterb.	*C. microcalyx* Ridley
C. capsulare Blanco	*C. farinosum* Wall.	*C. intermedium* Berthold Thomas*	*C. microphyllum* Berthold Thomas
C. cardiophyllum F.Muell.	*C. fasciculatum* Berthold Thomas	*C. involucratum* Vatke	*C. mildbraedii* Berthold Thomas
C. carnosulum Baker	*C. fastigiatum* H.J.Lam	*C. ixoraeflorum* Hazsk.	*C. minahassae* Teijsm. & Binn.
C. castaneaefolium Klotzsch	*C. ferrugineum* Turcz.	*C. jackianum* Wall.	*C. mindorense* Merrill
C. castaneifolium Hook. & Arn.	*C. finetii* Dop	*C. japonicum* Mak.*	*C. minutiflorum* Baker
C. catalpifolium H.Hallier	*C. fischeri* Gurke ex Engl.	*C. javanicum* Spreng.*	*C. mirabile* Baker
C. caulambum Exell	*C. fistulosum* Becc.*	*C. johnstoni* Oliver	*C. mite* Vatke
C. cauliflorum De Wild.*	*C. flavum* Merrill	*C. kaempferi* Fisch.ex Morr.	*C. moldenkeanum* Standley
C. cavaleriei Leveille	*C. fleuryi* A.Chevalier	*C. kalaotoense* H.J.Lam	*C. molle* H.B. & K.*
C. cephalanthum Oliver	*C. floribundum* Hort.*	*C. kalbreyeri* Baker	*C. montanum* Berthold Thomas

Table 1 (cont.) * Species described by more than one author.

C. morigono Chiov.	*C. poggei* Gurke	*C. schultzei* Mildbr.	*C. thyrsoideum* Baker*
C. mossambicense Klotzsch	*C. polyanthum* Guerke	*C. schweinfurthii* Gurke	*C. tomentellum* Hutchinson & Dalziel
C. moupinense Franch.	*C. polycephalum* Baker	*C. scopiferum* Miq.	*C. tomentosum* R.Br.
C. muenzneri Berthold Thomas	*C. populneum* Beer & H.J.Lam	*C. semiserratum* Wall.	*C. tonkinense* Dop
C. multibracteatum Merrill	*C. porphyrocalyx* K.Schum. & Lauterb.	*C. sereti* De Wild.	*C. toxicarium* Baker*
C. multiflorum G.Don	*C. powellii* Benth. & Hook.f.ex Drake	*C. sericeum* Wall.	*C. tracyanum* F.Muell.ex Benth
C. myrianthum Mildbr.	*C. preslii* Elmer	*C. serotinum* Carr.*	*C. transvaalense* Berthold Thomas
C. myricoides Gurke*	*C. preussii* Gurke.	*C. serratum* Moon*	*C. tricholobum* Guerke
C. myrmecophila Ridl.	*C. prittwitzii* Berthold Thomas	*C. sieboldii* Kuntze	*C. trichotomum* Thunb.*
C. natalense Gurke	*C. puberulum* Merrill	*C. silvaeanum* Henriques	*C. triflorum* Vis.
C. navesianum Vidal	*C. pubescens* Lindl.	*C. silvestre* Berthold Thomas	*C. trifoliatum* Steud.
C. nereifolium Wall.	*C. pubescens* Walp.	*C. silvicola* Guerke.	*C. triphyllum* H.H.W.Pearson
C. neumayeri Vatke	*C. pulchrum* Fawc.	*C. simile* H.H.W.Pearson*	*C. triplinerve* Rolfe
C. nhatrangense Dop	*C. pulverulentum* Engl.	*C. simplex* G.Don	*C. tuberculatum* A.Rich.
C. nipense Urb.	*C. pumilum* Ridley	*C. singalense* Miq.	*C. ubanghense* A.Chevalier
C. noiroti A.Chevalier	*C. pumilum* Spreng.	*C. singwanum* Berthold Thomas	*C. ugandense* Prain
C. nutans Jack*	*C. pusillum* Guerke	*C. sinuatum* Hook.	*C. ulei* Hayek
C. nyctaginifolium Good	*C. putre* Schau.	*C. siphonanthus*	*C. ulugurense* Guerke
C. obanense Wernham	*C. pygmaeum* Merrill	*C. somalense* Chiov.	*C. umbellatum* Poir.
C. obovatum Walp.	*C. pynaertii* De Wild.	*C. speciosissimum* Hort.Angl.ex Schau.	*C. umbratile* King & Gamble
C. obtusidens Miq.	*C. pyramidale* Andr.		*C. uncinatum* Schinz
C. odoratum D.Don	*C. quadrangulatum* Berthold Thomas	*C. speciosum* Guerke*	*C. urticifolium* Wall.
C. ohwii Kanehira & Hatusima	*C. quadriloculare* Merrill	*C. spicatum* Thunb.	*C. utakwense* Wernham
C. orbiculare Baker	*C. ramosissimum* Baker	*C. spinescens* Gurke	*C. validipes* S.Moore
C. oreadum S.Moore	*C. reflexum* H.H.W.Pearson	*C. spinosum* Spreng.	*C. vanoverberghii* Merril
C. ornatum Wall.	*C. rehmannii* Guerke	*C. splendens* A.Cheval.*	*C. vanprukii* Craib
C. ovale Klotzsch	*C. rhytidophyllum* K.Schum.	*C. splendidum* Wall.	*C. var. ifolium* De Wild.
C. ovalifolium A.Gray*	*C. ridleyi* King & Gamble	*C. squamatum* Vahl	*C. var. um* Berthold Thomas
C. ovatum Poir.*	*C. riedelii* Oliver	*C. squiresii* Merrill	*C. velutinum* A.Chevalier
C. oxysepalum Miq.	*C. ringoeti* De Wild.	*C. stenanthum* Klotzsch	*C. velutinum* Berthold Thomas*
C. palmatolobatum Dop	*C. robecchii* Chiov.	*C. streptocaulon* Hutchinson & Dalziel	*C. venosum* Wall.
C. paniculatum Linn.	*C. robinsonii* Dop		*C. verrucosum* Splitg.ex De Vriese
C. papuanum Scheff.	*C. robustum* Klotzsch	*C. strictum* Baker	*C. versteegi* Pulle
C. parvitubulatum Berthold Thomas	*C. roseum* Poit.	*C. stuhlmanni* Gurke	*C. verticillatum* D.Don
C. pearsoni Moldenke	*C. rotundifolium* Oliver	*C. subpandurifolium* Kuntze	*C. vestitum* Wall.ex Steud.
C. peekelii Markgraf	*C. rubellum* Baker	*C. subpeltatum* Wernham	*C. villosum* Blume
C. penduliflorum Wall.	*C. rumphianum* Bull	*C. subreniforme* Guerke	*C. violaceum* Guerke*
C. pentagonum Hance	*C. rumphianum* De Vriese	*C. subscaposum* Hemsl.	*C. viscosum* Vent.
C. petasites S.Moore	*C. rusbyi* Moldenke	*C. suffruticosum* Guerke	*C. volubile* Beauv.
C. petunioides Baker	*C. sagittatum* Wall.	*C. swynnertonii* S.Moore	*C. weinlandii* K.Schum.ex H.J.Lam
C. philippinense Elmer	*C. sagraei* Schau.	*C. sylvaticum* Briq.	*C. welwitschii* Gurke
C. philippinum Schau.	*C. sahelangii* Koord.ex Bakh.	*C. syringaefolium* Baker	*C. wenzelii* Merrill
C. phlebodes C.H.Wright	*C. sanguineum* K.Schum.	*C. talbotii* Wernham	*C. whitfieldii* Seem.*
C. phlomoides Hort.Ital.ex DC.*	*C. sansibarense* Gurke	*C. tanganyikense* Baker	*C. wildemanianum* Exell
C. phyllomega Steud.	*C. sarawakanum* H.J.Lam	*C. tatomense* Dop	*C. williamsii* Elmer
C. picardae Urb.	*C. savanorum* De Wild.	*C. teaguei* Hutchinson	*C. wilmsii* Guerke
C. pierreanum Dop	*C. scandens* Beauv.*	*C. ternatum* Schinz	*C. yakusimense* Nakai
C. pilosum H.H.W.Pearson	*C. scheffleri* Guerke*	*C. ternifolium* Baker*	*C. yatschuense* H.Winkler
C. pithecobium Standley & Steyerm.	*C. schlechteri* Guerke	*C. tessmanni* Moldenke	*C. yaundense* Guerke
C. pittieri Moldenke ex Standley	*C. schliebenii* Mildbr.	*C. thomasii* Moldenke	*C. yunnanense* Hu
C. pleiosciadium Gurke	*C. schmidtii* C.B.Clarke	*C. thonneri* Guerke	*C. zambesiacum* Baker

Table 2 A few species of the *Clerodendrum* genus described by many authors.

C. aculeatum (L.) Schlecht.	*C. floribundum* Hort.	*C. infortunatum* Dennst.	*C. ovalifolium* Bakh.
C. aculeatum Griseb.	*C. floribundum* R.Br.	*C. infortunatum* Gaertn.	*C. ovalifolium* Engl.
C. angustifolium Salisb.	*C. foetidum* Bunge	*C. infortunatum* Linn.	*C. ovatum* Poir.
C. angustifolium Spreng.	*C. foetidum* D.Don	*C. intermedium* Berthold Thomas	*C. ovatum* R.Br
C. attenuatum De Wild.	*C. foetidum* Hort.Par.ex Planch.	*C. intermedium* Cham.	*C. scandens* Beauv.
C. attenuatum R.Br.	*C. fortunatum* Buch.-Ham.ex Wall.	*C. japonicum* Mak.	*C. scandens* Druce
C. capense D.Don ex Steud.	*C. fortunatum* Linn.	*C. japonicum* Sweet	*C. scandens* Linn.ex Jackson
C. capense Eckl. & Zeyh.ex Schau.	*C. fragrans* Vent.	*C. javanicum* Spreng.	*C. scheffleri* Guerke
C. capitatum Hook.	*C. fragrans* Willd.	*C. javanicum* Walp.	*C. schifferi* A.Cheval.
C. capitatum Schum & Thou.	*C. glandulosum* Colebr.ex Wall.	*C. linnaei* F.Muell.	*C. serratum* Moon
C. cauliflorum De Wild.	*C. glandulosum* Lindl.	*C. linnaei* Thw.	*C. serratum* Spreng.
C. cauliflorum Vatke	*C. grandiflorum* Schau.	*C. macrocalyx* De Wild.	*C. simile* H.H.W.Pearson
C. coccineum D.Dietr.	*C. grandifolium* Gurke	*C. macrocalyx* H.J.Lam	*C. simile* Merrill
C. coccineum H.J.Lam	*C. grandifolium* Salisb.	*C. macrophyllum* Blume	*C. ternifolium* D.Don
C. congense Baker	*C. gratum* Kurz	*C. macrophyllum* Sims	*C. ternifolium* H.B. & K.
C. congense Engl.	*C. gratum* Wall.	*C. molle* H.B. & K.	*C. thyrsoideum* Baker
C. coriaceum Poir.	*C. hirsutum* G.Don	*C. molle* Jack	*C. thyrsoideum* Guerke
C. coriaceum R.Br.	*C. hirsutum* H.H.W.Pearson	*C. myricoides* Gurke	*C. toxicarium* Baker
C. divar. catum Jack	*C. holstii* Guerke ex Baker	*C. myricoides* R.Br. & Vatke	*C. toxicarium* Baker ex Gurke
C. divar. catum Sieb. & Zucc.	*C. holstii* Gurke.	*C. nutans* Jack	*C. velutinum* A.Chevalier
C. fistulosum Becc.	*C. indicum* Druce	*C. nutans* Wall.	*C. velutinum* Berthold Thomas
C. fistulosum Bower	*C. indicum* Kuntze	*C. ovalifolium* A.Gray	*C. velutinum* Wall.

and *C. foetidum* D. Don, *C. lanceolatum* F. Muell. and *C. lanceolatum* Gurke, etc.; some more examples are cited in **Table 2** (Rueda 1993; Hsiao and Lin 1995; Steane *et al*. 1999). Conclusive remarks on the origin and classification of the genus are still lacking and a thorough revision of the classification of this genus supported by molecular systematics has been suggested by some researchers (Steane *et al*. 1999, 2004).

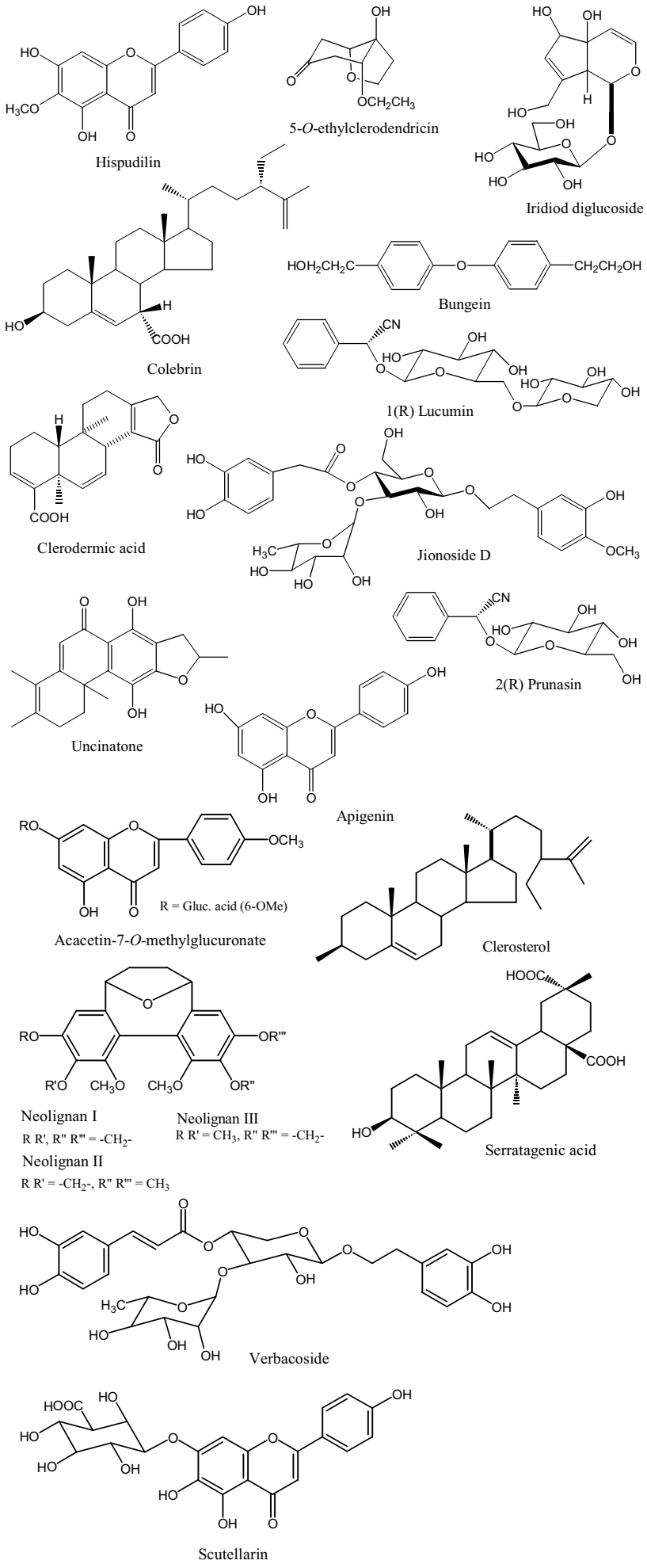

Fig. 1 Some of the major chemical constituents of *Clerodendrum* genus.

The genus is taxonomically characterized by its entire or toothed, oppositely arranged leaves, terete stems, terminally or axillary cymose inflorescence, hypogynous bisexual flowers, persistent calyx, cylindrical corolla tube with spreading 5-lobed at the top, exerted stamens, short bifided stigma, imperfectly 4-celled ovary, exalbumenous seeds and endocarp separating into 4 stony pyrenes (Kirtikar and Basu 1991; Hsiao *et al*. 1995; Steane *et al*. 1999). Resembling its taxonomic diversity, the genus exhibits a wide spectrum of folk and indigenous medicinal uses. Research is advancing towards scientific validation of classical therapeutic claims of the genus. In the present review we have focused on the medicinal and health care aspects of the genus. We have also included the work done on the phytochemical constituent responsible or believed to be responsible for the therapeutic properties of various species belong to the genus (**Fig. 1**).

ETHNOMEDICAL USES

A number of species from this genus were documented to be used as folk medicine by various tribes in Asian and African continents (**Table 3**). Many species of the genus have also been documented in traditional systems of medicine practiced in countries like India, China, Korea, Thailand and Japan.

Roots and leaf extracts of *C. indicum*, *C. phlomidis*, *C. serratum*, *C. trichotomum*, *C. chinense* and *C. petasites* have been used for the treatment of rheumatism, asthma and other inflammatory diseases (Anonymous 1992; Hazekamp *et al*. 2001; Kang *et al*. 2003; Panthong *et al*. 2003; Choi *et al*. 2004; Sungwook *et al*. 2004; Kanchanapoom *et al*. 2005). Plant species such as *C. indicum* and *C. inerme* were used to treat coughs, serofulous infection, buboes problem, venereal infections, skin diseases and as a vermifuge, febrifuge and also to treat Beriberi disease (Anonymous 1992; Rehman *et al*. 1997; Kanchanapoom *et al*. 2001). It was also reported that tribals use *C. inerme* as an antidote of poisoning from fish, crabs and toads (Rehman *et al*. 1997; Kanchanapoom *et al*. 2001; Pandey *et al*. 2003). *C. phlomidis*, *C. colebrookianum*, *C. calamitosum* and *C. trichotomum* have been reported to have antidiabetic, antihypertensive and sedative properties (Singh *et al*. 1980; Chaturvedi *et al*. 1984; Khan *et al*. 1996; Cheng *et al*. 2001; Kang *et al*. 2003; Chae *et al*. 2004; Choi *et al*. 2004). *C. cyrtophyllum* and *C. chinense* were used for the treatment of fever, jaundice, typhoid and syphilis (Cheng *et al*. 2001; Kanchanapoom *et al*. 2005). Roots, leaves and fresh juice of leaves of *C. infortunatum* were used in eliminating ascarids and tumors, and also as a laxative (Anonymous 1992). *C. phlomidis* has been used as an astringent and also in the treatment of gonorrhea (Rani *et al*. 1999; Murugesan *et al*. 2001). The roots of *C. serratum* have been claimed to be used in dyspepsia, seeds in dropsy and leaves as a febrifuge and in cephalagia and ophthalmia (Anonymous 1992). *C. calamitosum* was used as a medicine for the treatment of kidney, gall and bladder stones. This plant is also reported to have diuretic and antibacterial properties (Cheng *et al*. 2001). In the Chinese system of medicine *C. bungei* is used for the treatment of headaches, dizziness, furuncles and hysteroptosis (Zhou *et al*. 1982; Yang *et al*. 2002). In India, fruits of *C. petasites* are used to produce sterility, while in China the plant is used as medicine for malaria (Hazekamp *et al*. 2001; Panthong *et al*. 2003). Leaves of *C. buchholzii* are reported in African pharmacopeia for treatment of furunculosis, echymosis and gastritis (Nyegue *et al*. 2005). Other then their therapeutic use, some of the species of the genus such as *C. inerme*, *C. thomosonae*, *C. indicum* and *C. speciosum* are also cultivated and used as ornamental plants.

PHYTOCHEMISTRY

As mentioned earlier the genus *Clerodendrum* is reported in various indigenous systems of medicine throughout the world for the treatment of various diseases. Efforts have been made by various researchers to isolate and identify biologically active principle and other major chemical constituents from various species of the genus. Research reports on the genus denote that the major class of chemical constituents present in the *Clerodendrum* genus are steroids such as β-sitosterol, γ-sitosterol octacosanol, clerosterol, bungein A, acteoside, betulinic acid, clerosterol 3-O-β-D-glucopyranoside, colebrin A-E, campesterol, 4α-methylsterol, cholesta-5-22-25-trien-3-β-ol, 24-β-cholesta-5-22-25-trine, cholestanol, 24-methyl-22-dihydrocholestanol, 24-β-22-25-bis-dehydrocholesterol, 24-α-methyl-22-dehydrocholesterol, 24-β-methyl-22-dehydrocholesterol, 24-ethyl-22-dehydrocholesterol, 24-ethylcholesterol, 22-dehydroclerosterol, 24-methyllathosterol, 24-β-ethyl-25-dehydrolathosterol, (24S)-ethylcholesta-5-22-25-triene-3β-ol have been isolated from various *Clerodendron* species such as *C. inerme*, *C. phlomidis*, *C. infortunatum*, *C. paniculatum*, *C. cyrtophyllum*, *C. fragrans*, *C. splendens*, *C. campbellii* and *C. splendens* (Bolger *et al*. 1970; Abdul-Alim 1971; Joshi *et al*. 1979; Sinha *et al*. 1980; Singh and Singhi 1981; Sinha *et al*. 1982; Hsu *et al*. 1983; Singh and Prakash 1983; Singh and Singhi 1983; Pinto and Nes 1985; Rempler and Hunkler 1986; Akihisa *et al*. 1989; Att-Ur-Rehman *et al*. 1997; Goswami *et al*. 1996; Yang *et al*. 2000; Kanchanapoom *et al*. 2001; Yang *et al*. 2002; Gao *et al*. 2003a, 2003b; Pandey *et al*. 2003; Kanchanapoom *et al*. 2005; Lee *et al*. 2006).

Another class of constituents are terpenes which include: monoterpenes, diterpenes, triterpenes, iridoids and sesquiterpenes. Terpenes such as α-amyrin, β-amyrin, caryoptin, 3-epicaryoptin, 16-hydroxy epicaryoptin, clerodendrin A, B and C, clerodin, clerodermic acid, cleroinermin, friedelin, gramisterol, iridoids (inerminoside A, B, C and D, melittaside, monomelittoside, sammangaoside, ugandoside, 8-*O*-acetylmioporoside), obtusifoliol, oleanolic acid, royleanone, dehydroroyleanone, sesquiterpene (sammangaoside A,

Table 3 A few species of *Clerodendrum* genus and their distribution in the world.

Scientific Name	Synonym	Distribution
C. inerme Gaertn.		India, Sri Lanka, South East Asian countries, Australia, Pacific Islands
C. phlomidis Linn. f.	*C. multiforum* Burm. f.	India
C. serratum Spreng.		India
C. infortunatum Linn.		The Philippines
C. siphonanthus R. Br.	*C. indicum* (Linn) Kuntze	India
C. commersonii Spreng.		China
C. glabrum E. Mey.		Southern Africa
C. triphyllum R. Br.		Southern Africa
C. trichotomum		China, Korea, Japan
C. bungei Stued.		China
C. calamitosum L.		Indonesia, Taiwan
C. cyrtophyllum Turez.		Taiwan
C. chinense (Osb.) Mabberley	*C. fragrans* (Vent.) Willd.	Tropical regions of Asia
C. colebrookianum		India, South Asian countries
C. myricoides		South Africa
C. petasites S. Moore		India, Malaysia, Sri Lanka, Vietnam, Southern China
C. philippinum Schauer		Queensland, Australia
C. heterophyllum R. Br. & Thb.		Southern Africa

B) clerodendrin A, uncinatone, Mi saponins-A, friedelanone, lupeol, betulinic acid, royleanone and dehydroroyleanone, and betulin have till now been isolated from various *Clerodendron* species such as *C. inerme*, *C. phlomidis*, *C. paniculatum*, *C. colebrookianum*, *C. wildii*, *C. uncinatum*, *C. mandarinorum*, *C. thomsonae*, *C. fragrans*, *C. ugandense*, *C. chinense* (Joshi *et al*. 1979; Sharma and Singh 1979; Singh *et al*. 1981; Sinha *et al.* 1981; Seth *et al*. 1982; Singh and Prakash 1983; Achari *et al*. 1990; Raha *et al*. 1991; Achari *et al*. 1992; Rao *et al*. 1993; Calis *et al*. 1994; El-Shamy *et al*. 1996; Kawai *et al*. 1998; Hazekamp 2001; Kanchanapoom *et al*. 2001; Yang *et al*. 2002; Kumari *et al*. 2003; Chae *et al*. 2004; Dorsaz *et al*. 2004; Nishida *et al*. 2004; Min *et al*. 2005).

Flavonoids are another class of compounds which are mainly present in *Clerodendron* speices and they are also responsible for few biological activities. The major flavonoids present are cynaroside, 5-hydroxy-4'-7-dimethoxy methyl flavone, kaempferol, salvigenin, 4-methyl scutellarein, 5,7,4 O-trihydroxyflavone, apigenin, luteolin, acacetin-7-*O*-glucuronide, hispidulin, 2'-4-4'trihydroxy-6'methyl chalcone, 7-hydroxy flavone, luteolin, naringin-4'-O-*α*-glucopyranoside, pectolinarigenin, cirsimaritin, cirsimaritin-4'-glucoside, quercetin-3-methyl ether which were isolated from *C. inerme*, *C. phlomidis*, *C. petasites*, *C. trichotomum*, *C. mandarinorum*, and *C. infortunatum* (Vendatham *et al*. 1977; Seth *et al*. 1982; Raha *et al*. 1989; Achari *et al*. 1990; Raha *et al*. 1991; Roy and Pandey 1994, 1995; Roy *et al*. 1995 ; El-Shamy *et al*. 1996; Anam 1997, 1999).

There are also other chemical constituents present which include volatile constituents such as 5-O-ethylclerodindicin D, linalool, benzyl acetate and benzyl benzoate, which have been isolated from *C. canescens*, *C. cyrtophyllum*, *C. inerme* and *C. philippinum* (Yang *et al*. 2002; Nyegue *et al*. 2004; Wong and Tan 2005).

Other chemical constituent includes cyanogenic glycosides such as lucumin and prunasin which were isolated from *C. grayi* (Miller *et al*. 2006). Phenolic compounds like *β*-benzyl alcohol, *β*-benzyl alcohol-D-glucoside, neolignan, darendoside-B, phenyl propanoids like (isovarbascoside, verbascoside, leucosceptoside), vanillic acid, anisic acid, para-hydroxy benzoic acid, gallic acid have been reported in *C. inerme*, *C. bungei* and *C. dauricum* (Liu and Fu 1980; Gabriele and Rimpler 1981; Zhou *et al*. 1982; Gabriele *et al*. 1983; Sakurai and Kato 1983; Calis *et al*. 1994); D-mannitol from *C. serratum* (Garg and Verma 2006). Carbohydrates like glucose, fructose, sucrose are been reported in *C. mandarinorum* and *C. inerme*. Other constituents such as ribosome-inactivating protein, salidroside, jinoside-D, acetoside have been isolated from *C. inerme* (Olivieri *et al*. 1996), while trichotomoside, cytotoxic pheophorbides and cleromyrin-I have been isolated from *C. trichotomum*, *C. calamitosum* and *C. cyrtophyllum* (Bashwira *et al*. 1989; Cheng *et al*. 2001; Chae *et al*. 2006).

BIOLOGICAL ACTIVITIES

The genus C*lerodendrum* contains many plant species that are being used in various health care systems for the treatment of various disorders including life-threatening diseases. To validate traditional claims associated with the genus many studies are being carried out using various animal models and *in vitro* assays. These studies showed that the different species of the genus possess potent anti-inflammatory, antidiabetic, antimalarial, antiviral, antihypertensive, hypolipidemic and antioxidant activities and have potential to be developed as potent remedial agents from natural resources. Some major activities are described below.

Anti-inflammatory activities

Inflammation is a very complex pathophysiological process involving a variety of biomoleucles responsible for causing it such as leucocytes, macrophages, mast cells, platelets and lymphocytes by releasing eicosanoids and nitric oxide. Pro-inflammatory cytokines such as TNF-α and IL-1β are also responsible for various inflammatory conditions. Many species of the genus *Clerodendrum* showed potent anti-inflammatory activity. *C. phlomidis* was reported for significantly decreasing paw oedemas induced by carrageenan in rats at a dose of 1g/kg (Surendrakumar 1988). Similarly *C. petasites* was reported to show moderate anti-inflammatory activity in the acute phase of inflammation in rats. The ED_{50} values of the experiment were reported to be 2.34 mg/ear and 420.41 mg/kg in rats (Panthong *et al*. 2003), it has been suggested by the authors that the anti-inflammatory activity of the plant extract could be due to the inhibition of prostaglandin synthesis by the extract.

The anti-inflammatory activity of *C. trichotomum* leaves were checked in rat, mice and Raw 264.7 macrophage cells using experimental models with 1 mg/kg solution of 30% and 60% methanolic extracts of leaves. Experimental results concluded that inhibition by methanolic extract was comparable to that of the positive control in an acute inflammation model, while in the chronic model the extract showed 10% higher activity than the positive control. It also suppressed the levels of prostaglandin E2 (PGE2) in RAW 264.7 macrophage cells (Choi *et al*. 2004). A phenyl propanoid glycoside 'acetoside' isolated from *C. trichotomum* also showed anti-inflammatory activity by inhibiting the release of histamine, arachidonic acid and prostaglandin E2 in RBL 2H3 cells. The mechanism identified for the inhibition of histamine release was related to calcium concentration (Lee *et al*. 2006).

Xanthine oxidase (XO) is the enzyme responsible for the formation of uric acid from the purines hypoxanthine and xanthine, and is responsible for the medical condition, gout. Gout is caused by the deposition of uric acid in the joints leading to painful inflammation. Purified hydroalcoholic extracts of leaves and branches of *C. floribundum* showed 84% inhibition of XO activity (Sweeney *et al*. 2001). Results of the experiment indicate the potential of the plant species to be developed as a remedy for XO-induced diseases.

Flavonoid glycosides of *C. inerme* showed modulation in calcium transport in isolated inflamed rat liver and thereby showed reduction in inflammation. The results obtained in the experiment were comparable with indomethacine used as a positive control (Somasundram and Sadique 1986). The alcoholic extract of roots of *C. serratum* showed a significant anti-inflammatory activity in carrageenan and also in the cotton pellet model in experimental mice, rats and rabbits (Narayanan *et al*. 1999).

Antimicrobial activites

Antiinfective compounds from natural resources are of great interest as the existing drugs are getting less effective due to increased tolerance of microorganisms. A number of species from the genus *Clerodendrum* were documented in ancient texts for their antimicrobial action. To validate these claims, research work was carried out with various Gram positive and Gram negative bacterial strains and also with fungal and viral pathogens. Dried, aerial parts of *C. inerme* showed potent antiviral activity against Hepatitis B virus with an ED_{50} value of 16 μg/ml (Mehdi *et al*. 1997). Essential oil obtained from leaves of the plant showed antifungal activity against variety of fungal species such as *Alternaria* species, *Aspergillus* species, *Cladosporium herbarum*, *Cunnimghamella echinulata*, *Helminthosporium saccharii*, *Microsporum gypseum*, *Mucor mucedo*, *Penicillium digitatum*, *Rhizopus nigricans*, *Trichophyton rubrum* and *Trichothecium roseum* (Sharma and Singh 1979). Alcoholic extracts of leaves and flowers of *C. inerme* also exhibited antibacterial activity against *Escherichia coli* and *Staphylococcus aureus* (George and Pandalai 1949). Pectolinarigenin and chalcone glucoside isolated from leaf of *C. phlomidis* showed antifungal activity (Roy *et al*. 1995).

Two phenyl propanoid glycosides (acteoside and acteoside isomer) isolated from *C. trichotomum* showed potent

inhibition of HIV-1 integrase with IC_{50} values of 7.8 ± 3.6 and 13.7 ± 6.0 µM (Kim *et al*. 2001). A new hydroquinone diterpenoid was isolated from *C. uncinatum* and was strongly fungi toxic to the spores of *Cladosporium cucumerinum* (Dorsaz *et al*. 2004). Hexane extracts of *C. colebrookianum* at concentrations of 1000 and 2000 ppm showed strong antibacterial activities against various Gram positive and Gram negative pathogens such as *S. aureus*, *Staphylococcus haemolyticus*, *E. coli*, *Pseudomonas aeruginosa* (Misra *et al*. 1995).

Two flavonoids from roots of *C. infortunatum*, cabruvin and quercetin, showed strong antifungal activity. The former showed activity against *Alternaria carthami* and *Helminthosporin oryzae*, the latter against *Alternaria alternate* and *Fusarium lini* at concentrations of 200, 500 and 1000 mg/ml (Roy *et al*. 1996). Mi-saponin-A, a triterpenoid saponin isolated from the roots of *C. wildii*, showed potent antifungal activity against *Cladosporium cucumerinum* (Toyoto *et al*. 1990).

Antimalarial activities

In various ancient literatures related to healthcare *Clerodendrum* have been reported for its antimalarial activities because of the presence of a bitter principle. Studies with different parasites support these ancient claims. The alcoholic extract of *C. phlomidis* showed antimalarial activity against *Plasmodium falciparum* with an IC_{50} value of 48 µg/ml (Simonsen *et al*. 2001). Another Indian species, *C. inerme* also inhibited the growth of larvae of *Ades aegypti*, *Culex quinquefasciatus* and *Culex pipiens* at 80 and 100 ppm concentration of petroleum ether and ether extracts (Gayar and Shazll 1968; Kalyanasundaram and Das 1985). *C. myricoides* a species from Southern Africa was also tested positive for its antimalarial activity against both sensitive and resistant strains of *P. falciparum* with IC_{50}< 30 µg/ml (Muregi *et al*. 2004), it also showed 31.7% suppression in parasitaemia against cloroquine tolerant strain of *Plasmodium berghei* NK65 (Muregi *et al*. 2007). These plants may be useful as a source for novel anti-plasmodial drugs/compounds from natural origin.

Antioxidant activities

Antioxidant compounds are responsible for scavenging free radicals, which are produced during normal metabolism or during adverse conditions that can be harmful to biological systems and leading to death of an organism. Species like *C. inerme* have been used as antioxidant drugs in various indigenous systems of medicines (Masuda *et al*. 1999). Organic and aqueous extracts of *C. colebrookianum* showed significant inhibition of lipid peroxidation *in vitro* and *in vivo* induced by $FeSO_4$-ascorbate in rats. Aqueous extracts showed strongest inhibitory activity over organic extracts. This lends scientific support to the therapeutic use of the plant leaves claimed in tribal medicine (Rajlakshmi *et al*. 2003). Isoacteoside, trichotomoside and jionoside D, three compounds isolated from *C. trichotomum*, when tested showed significant scavenging activity of intracellular reactive oxygen species produced by hydrogen peroxide suggesting their antioxidant properties (Chae *et al*. 2004, 2005, 2006). Apigenin-7-O-*β*-D-glucuronopyranoside (AGC), isolated from *C. trichotomum* leaves decreased the volume of gastric juice and increased the gastric pH in a dose-dependent manner, decreasing the number of gastric lesions. A malondialdehyde (MDA) level, which is the end product of lipid peroxidation, was also decreased by AGC (i.d. 3 mg/kg), which increased significantly after the induction of reflux oesophagitis. The MDA levels did not decrease when either apigenin or omeprazole were used as a control suggesting that AGC has an antioxidative mechanism to reduce gastric lesions. Apigenin glucuronopyranoside also decreased mucosal glutathione (GSH) levels significantly suggesting that AGC possesses free radical scavenging activity. So it can be concluded that AGC is more potent in inhibiting reflux oesophagitis and gastritis and may therefore be a promising drug for their treatment (Min *et al*. 2005). In present lifestyles where stress has taken an unwanted important position leading to excess production of free radicals these natural remedies will prove a support to our biological system to balance metabolism.

Other biological activities of *Clerodendrum* genus

Other major biological activites reported for this genus are antihypertensive, antitumor, antidiabetic, antihyperlipidemic, larvicidal, antidiarrhoel activities. Organic extracts of *C. inerme* showed strong uterine stimulant activity when tested in female rats and rabbits (Sharaf *et al*. 1969), and also showed strong antihemolytic activity in human adults at 0.02-2.0 mg/ml, with inhibition of phospholipase at 0.05-1.5 mg/ml (Somasundaram and Sidique 1986). The methanolic extract of *C. multiflorum* leaves showed antidiarrhoeal activity against castor oil-induced diarrhoea, PGE_2-induced enteropooling and caused reduction in gastrointestinal motility in rats (Rani *et al*. 1999), while leaf juice at 0.1% showed anthelmentic activity against *Ascaris lumbricoides*, *Phreitima posthuma* and *Taenia solium* (Garg and Sidique 1992). Two compounds, isoacteoside and jionoside D isolated from *C. trichotomum* also reduced the levels of apoptotic cells induced by the action of hydrogen peroxide (Chae *et al*. 2004, 2005). *C. bungei* showed antitumor activity in hepatic cells of mice at a dose of 100 g/kg (Shi *et al*. 1993). CNS-related activities were also observed in *C. phlomidis* showing tranquillizing, CNS depressant, muscle relaxant and psychopharmacological effects in experimental mice and rats (Murugesan *et al*. 2001). *C. mandarinorum* root extracts showed strong binding with opiate, adenosine-1, α-2-adrenergic, 5HT-1, 5HT-2, dopamine-2, histamine-1, GABA (A), and GABA (B) receptors. Isolated compounds of these plants showed weak binding with these recepters suggesting its synergestic effect (Zhu *et al*. 1996). *C. inerme* extracts showed hypotensive effects in dogs at 50 mg/kg (Bhakuni *et al*. 1969).

A decoction of the entire *C. phlomidis* plant has been reported to have antidiabetic activity. A dose of 1 g/kg showed antidiabetic effects in epinephrine and alloxan induced hyperglycemia in rats and it also showed antihyperglycemic activity in human adults at a dose of 15-30 g/day (Chaturvedi *et al*. 1984). Organic and crude extracts of *C. colebrookianum* significantly lowered the serum lipid profile in rats suggesting that it has cardioprotective potential (Devi and Sharma 2004). The methanolic extract of *C. phlomidis* and leaf extracts of *C. inerme* showed antispasmodic activity in mouse (200 mg/kg; Murugesan *et al*. 2001) and guinea pigs (2 mg/ml; Cox *et al*. 1989). Ethanolic extract (2.25-9.0 mg/ml) of *C. petasites* evaluated for spasmolytic activity in guinea-pigs showed spasmolysis on tracheal smooth muscles; it also relaxed the smooth muscle which was contracted by exposure to histamine. The activity of smooth muscle relaxation was attributed to hispidulin (flavonoid) with an EC_{50} ($3.0 \pm 0.8 * 10^{-5}$ M) suggesting hispidulin has anti-inflammatory activity (Hazekamp 2001). Dichloromethane leaf extracts of *C. myricoides* indicated antimutagenic properties against *Salmonella typhimurium* TA98 and TA100 bacterial strains (Reid *et al*. 2006).

No adverse effects of the genus have been reported in the literature until now. Various species of the genus like *C. infortunatum*, *C. serratum*, *C. phlomidis* have been reported to be safe in the prescribed dosage in traditional system of medicines (Anynomous 1; Sharma PV 2001).

SUMMARY

The genus *Clerodendrum* has been cited in many indigenous systems of health care for the treatment of variety of disorders. A few species extensively used as folk medicines for years have been investigated for their chemical constituents and biological activity to confirm these traditional claims. The genus is reported to have activities against a wide spec-

trum of disorders which includes many life-threatening diseases like HIV. Still there are many species of the genus having a potential towards many disorders in their unexplored fold.

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