

History and a Phytopharmacological Review of Curcuma Amada

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Abstract:

Plants are one of the main sources of biologically active materials and crude drugs. *Curcuma amada* is a plant that belongs to *Zingiberaceae* family of curcumin. *Curcuma amada* (*Zingiberaceae*) basically known as mango ginger because its flavour of rhizome and foliar parts have a similar aroma to mango. It is one of the most important species of *Curcuma* family having medicinal, traditional and biological properties. The aim of the present review is to know about the phytochemicals, volatile compounds, antimicrobial and other biological activities. Volatile oils extracted from rhizomes of *Curcuma amada* are rich in phytoconstituents. The curcuminoids present in *C.amada* is responsible for its therapeutic and biological activities. It is traditionally used to treat various diseases in human being which includes anti-inflammatory, anti-bacterial, anti-cancer, anti-tubercular, anti-allergy, anthelmintic and anti-pyretic activities by their extract. It also possesses healing of various skin disorders. In Ayurveda and Unani systems of medicine have given much importance to mango ginger as an appetizer, alexteric, antipyretic, aphrodisiac, diuretic, emollient, expectorant and laxative and to cure biliousness, itching, skin diseases, bronchitis, asthma, hiccough and inflammation due to injuries. They also used in the manufacture of pickles, chutney, salad and jam.

Keywords: *C. amada*, *Zingiberaceae*, History, Phytopharmacology

Introduction:

From ancient era allopathic treatment with contemporary amenities in developing countries, 60% world population still depending on plants for treating diseases. Around 75% of the human population in the world is following their traditional or Ayurvedic and Unani medicine.¹ Mango ginger (*Curcuma amada*.) is a rhizome, a aromatic herb of the ginger family, *Zingiberaceae*.² *Curcuma* genus contains 60 to 100 species of curcumin, found in different countries of the world including northern Australia, Indian subcontinent, America, Southeast Asia, New Guinea, tropical Africa, southern China etc.³ which are mostly used in both fresh and dried form for flavoring pickles and other vegetarian and meat dishes. The plant of *C. amada* between 60–90 cm in height; leaves are green, long, etiolate and oblong-lanceolate; flowers are white or pale yellow in spikes present at the centre of the tuft of leaves.⁽²⁾ *C. amada* are rich in phytoconstituents. It provides strength to the stomach and digestive system, is carminative and expectorant. It helps in relief in digestive complaints such as abdominal gas problems, constipation, colic, indigestion, bad breath, stomach pain, loss of appetite, wind, indigestion. It effectively helps to reduce and cure bronchitis, asthma and cough internally. The external application

of mashed and grated root of *curcuma amada* is useful in the treatment of sprains, wounds, bruises and ulcers disease.⁽¹⁾ They were copiously used in Ayurvedic, Unani, Sidha and other traditional medicine. The word probably derives from the Arabic word ‘kurkum’, which means yellow color. The systematic position of the plant *C. Amada* is as follows.

Kingdom: Plantae
Subkingdom: Spermatophyta
Division: Magnoliophyta
Subdivision: Angiospermae
Class: Monocotyledonae
Series: Epigynae
Order: Scitaminales
Family: Zingiberaceae
Genus: *Curcuma*
Species : *C amada* Roxb ⁽⁴⁾



Figure 1: Mango ginger plant (A), rhizomes (B) and TS of rhizome (C).

It has been also used in the Ayurveda and Unani medicinal systems as a diuretic, laxative, appetizer, antipyretic, aphrodisiac, emollient, and expectorant from ancient era. More than 150 compounds have been reported in *C.amada* essential oil extracted by hydro or steam distillation of the fresh or dry rhizome of *curcuma amada*.⁽⁵⁾

History/Origin

The antiquity of turmeric (curcumin) dates back to ‘Atharva Veda’ of 1000–1500 BC, a holy treatise of the Hindus, as ‘Haldi’ or ‘Haridrar’ (AV/1/22/4) (Shah, 1997)⁽³⁾. However, the ancient Indian system of medicine, Ayurveda (Science of Life), of approximately 5000 years of antiquity mentions the medicinal uses of turmeric. Ethnobotanical evidence indicates that the use of turmeric has been in India since ancient days, connected with the ‘Sakthi’ worship or worship of Mother Goddess. According to Marco Polo (1280), turmeric reached China in 700 AD (Ridley, 1912)⁽⁸⁾. Pursglove *et al.* (1981) stated that the people of Malagasy believed in a Malaya–Polynesian connection in the origin of turmeric in that country by the Pre-Aryan Indians.⁽⁶⁾ The word *Curcuma* probably derived from the Arabic word ‘kurkum’, which means yellow color. It was reported that mango ginger was originated from India and

widely distributed in the tropics regions of Africa, Australia and Asia. The mango ginger is known by different names depending on the location of country in the world. In England, it is typically called mango ginger. In India, specifically in Hindi Amahald and amahaldi, in Bangladesh it is called amada. Similarly, it is known as temu mangga in France, ama adrak in Pakistan and mangoingwer in Germany.⁽³⁾ *C.amada* was originated in the Indo-Malayan region and distributed widely in the tropics from Asia to Africa and Australia. It is usually found in Srilanka, Bangladesh and South and east asian countries.⁽¹⁾

Phytochemistry of C.Amada:

Curcuminoids in *C.amada*

The main active ingredient in turmeric is known as curcumin. It has better antioxidant and anti-inflammatory properties. Curcuminoids are known as polyphenolic a pigment which includes curcumin, demethoxycurcumin and bismethoxycurcumin⁽¹²⁾. Three major curcuminoids were present in acetone extract of *C.amada* (Gupta *et al.*, 1999). Figure 1 illustrated the structure of curcumin, demethoxycurcumin, bismethoxycurcumin present in *C.amada*.

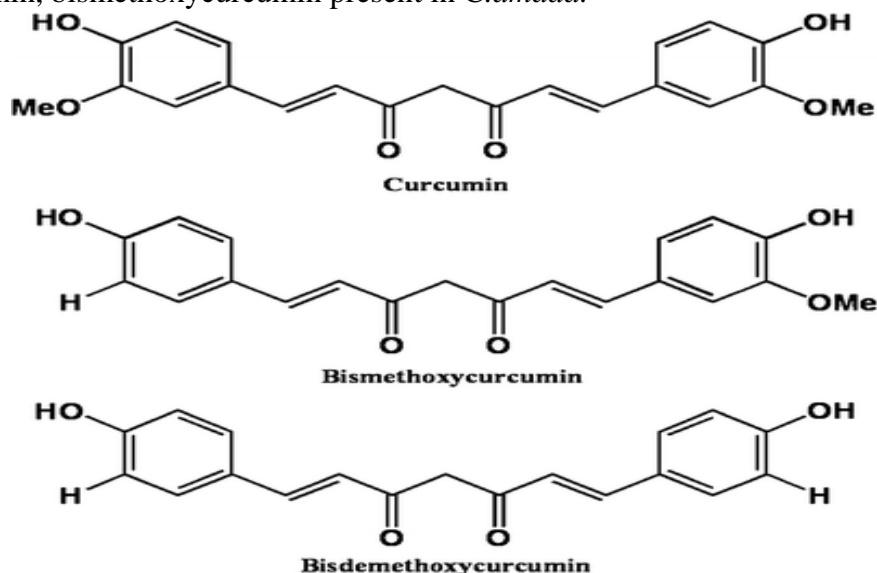


Figure 1: Structure of curcumin, demethoxycurcumin, bismethoxycurcumin present in *C.amada*

(A)

In the study, the curcuminoid contents of *Curcuma amada* quantitatively after exposing it to gamma rays with doses of 5 and 10 kGy.⁽⁵⁾ The results were then compared to the results for the unirradiated *Curcuma amada* rhizomes. From the HPLC analysis, it was found that the curcuminoid compounds in *Curcuma amada* consisted of curcumin (C), demethoxycurcumin (DTC), and bisdemethoxycurcumin (BDTC).⁽¹¹⁾ This results was in accordance with curcumin, demethoxycurcumin and bisdemethoxycurcumin standards. DTC was detected as the main component in *Curcuma amada*.⁽⁷⁾

Table 1: Phytochemical screening of *Curcuma amada*⁽¹⁾

S.	Phytochemicals	Rhizome Extract	References No
1	Glycosides	Ethanol	
2	Alkaloids	Ethanol, Methanol, Distilled water	Mahadevi R, Kavitha R*)
		Aqueous, Ethanol	

3	Tannins	Ethanol, Methanol, Distilled water	
		—	
4	Flavanoids	Ethanol, Methanol, Distilled water	
		Aqueous, Ethanol	
5	Saponin	Distilled water	
6	Terpenoid	Chloroform, Ethanol, Methanol, Distilled water	
7	Phlobatannin	Ethanol, Methanol, Distilled water	
8	Cardiac glycosides	Chloroform, Ethanol, Methanol, Distilled water	
9	Protein	Ethanol, Methanol	
10	Coumarin	Chloroform, Ethanol, Methanol, Distilled water	
11	Gum	Chloroform, Ethanol, Methanol, Distilled water	
12	Emodins	—	
13	Phytosterol	Ethanol, Methanol, Distilled water	
14	Anthraquinone	Ethanol, Methanol	
15	Chalcones	—	
16	Cysteine	—	
17	Ligands	Ethanol, Distilled water	
18	Leucoanthocyanin	—	
19	Elagic acid	Ethanol, Methanol	
20	Glycosides	Ethanol	
21	Steroids	—	
22	Sterols	—	
23	Reducing sugar	Aqueous, Ethanol	
24	Phenolic compounds		
25	Terpenoids		
26	Volatile oils		

PHYTOCHEMICAL DESCRIPTION:

Mango ginger contains small amount of fat contents and gives less caloric contents. It exhibits majorly phenolic class of fatty acids (Das *et al.*, 1997)⁽¹³⁾. It is well known for source starch⁽³⁾⁽⁸⁾, carbohydrates and certain mineral contents. The manganese (Mn) and cobalt (Co) were reported in roots of mango ginger.⁽¹⁵⁾ Mango ginger has a good aromatic smell due to the presence of essential oil contents. These contents are varied with different season [10] and are analyzed by GC-MS analysis The alpha pinene compound of essential oil has specially contributed in aroma of plant.⁽⁶⁾ The flavanoids, terpinoids, tannins steriodas, alkaloids and glycosides compounds are also including in mango ginger ⁽³⁾ More than 130 chemical constituents have been reported in *C.amada* rhizomes, of which 121 have been identified. All of the reported chemical constituents were extracted from either fresh or dried *C.amada* rhizomes.⁽⁹⁾ Most studies of the chemical constituents of mango ginger focused on the rhizome, with other plant parts

rarely examined (Mustafa *et al.*, 2005; Prakash *et al.*, 2005; Singh *et al.*, 2003; Srivastava *et al.*, 2001; Behura, 2000; Choudhury *et al.*, 1996; Gupta *et al.*, 1999; Rao *et al.*, 1989; Ahuja and Nigam, 1971; Dutt and Tayal, 1941). The major chemical constituents of *C. amada*, based on percent yield, are myrcene (88.6%), ocimene (47.2%), ar-turmerone (29.12%), (Z)- α -farnasene (21.9%), guaia-6,9-diene (19.8%), *cis*- β -ocimene (18.8%), *cis*-hydroocimene (18.79%), *trans*hydroocimene(15.94%), β -longipinene (14.8%), β -guaiene (14.5%), linalool (13.37%), β -curcumene (11.2%) and turmerone (10.8%).⁽¹⁰⁾

Volatile constituents:

Volatile oils otherwise known as essential oils which are derived from plants are used for aromatherapy, a form of alternative medicine in which healing effects is attributing to aromatic compounds .⁽¹²⁾Leaves of *C.amada* containing some volatile compounds which were shown in Table 2.⁽⁴⁾ There are many reports on the composition of mango ginger volatile oil.⁽¹¹⁾ The mango flavour is mainly attributed to presence of car-3-ene and *cis*-ocimene among the 68 volatile aroma components present in the essential oil of mango ginger rhizome⁽³⁾⁽⁸⁾ (Dutt and Tayal 1941; Golap and Bandyopadhyaya 1984; Rao et al. 1989; Choudhary et al. 1996; Srivastava et al. 2001; Singhet al. 2003a,b; Mustafa et al. 2005). The *cis*- and *trans*hydroocimene,ocimene and myrcene were found to be the major compounds present in the volatile oils of *C. amada*.⁽⁸⁾ *C. amada* essential oil obtained by hydro- or steam distillation of the fresh or dry rhizome⁽¹⁵⁾ The VOCs in *C. amada* are vital, not merely due to their biological activity but are important both for taxonomic research and for understanding the interaction of plants with each other and with the environment ⁽⁷⁾The objective of the present study was the analysis of VOC profiles of three *C. amada*(ZO45, ZO89, and ZO114) and one *C. longa* (ZO138) accessions by means of HS-SPME coupled with GC-TOF-MS technique. ⁽⁵⁾

List of *C.amada* species with indicated accessions:

Accession No.	Species	Country of Origin	Source	Year of acquisition with SMTA
ZO45	<i>C.amada</i>	Myanmar	Genebank	2004
ZO89	<i>C.amada</i>	Thailand	Rural market	2005
ZO114	<i>C.amada</i>	Myanmar	Local farm	2004

PHARMACOLOGICAL PROPERTIES:

Mango ginger has many biological activities due to the presence of curcuminoids (curcumin, des-methoxy curcumin, demethoxy curcumin).⁽⁵⁾ Curcumin has been shown to be associated with a large number of physiological and medicinal properties *Mango ginger* gives good healthy results in small amount of consumption. It is rich in antioxidant properties and certain mineral compounds. It gives some side effects of large amount consumption of mango ginger. ⁽²⁾⁽³⁾ Mango ginger essential oil is known to have strong antioxidant properties.⁽¹¹⁾ Research has showed that mango ginger essential oil exhibited anti-microbial and anti-cancer properties. It had reported that rhizomes extract of mango showed highest anti hyperglycemic activity at dose of 650mg/kg and extracts of mango ginger killed the earthworms at dose 150 mg/ml. ⁽³⁾ . The ancient testimony for the use of plants as medicine was well documented in the treatise of Ayurveda and dates back to the pre-historic Vedic era. Accordingly,⁽¹⁾ the

medicinal properties of mango ginger are depicted in the following Sankrit shloka: Raw mango flavoured ginger has a cooling effect on the body. It aggravates Vata. It also pacifies deranged Pitta, cures all types of itching and skin diseases.⁽⁹⁾

Ayurveda, the oldest system of medicine in India, attributed multiple uses of rhizome as an appetizer, alexteric, antipyretic, aphrodisiac and laxative.⁽⁹⁾⁽¹³⁾ Additional health benefits of *C. amada* rhizome reported were biliousness, itching, skin diseases, asthma and inflammation due to injuries (CSIR 1950).⁽³⁾ According to the Unani systems of medicine, it is a diuretic, maturant, emollient, expectorant, antipyretic and appetizer.⁽¹⁰⁾ Moreover, several reports have demonstrated the *C. amada* rhizome's ability against inflammation in the mouth and ear, gleet, ulcers on the male sex organs, scabies, lumbago and stomatitis (Kirtikar and Basu 1984; Warriar et al. 1994; Hussain et al. 1992).⁽⁸⁾

Anti-bacterial activity:

The rhizomes essential oil exhibits significant antibacterial activity. Difurocumenonol, amadannulen and flavonoids are responsible for the antibacterial activity of mango ginger.⁽⁸⁾ The chloroform rhizomes extract of mango ginger was used for determination of antibacterial activity against *P.aeruginosa* *M. luteus*, *S.aureus*, *E. coli*, *S. typhi*, *E. fecalis*, *B. subtilis*, *B. cereus* *K. pneumoniae*, *Y. enterocolitica*, *E. aerogenes*, *P. mirabilis*, and *L. monocytogenes*. Another study reveal that rhizome of mango ginger exhibited significant antibacterial activity against various bacterial strains *S. aureus*, *S. typhi*, *S. dysenteriae*, *P. aeruginosa*, *P. mirabilis*, *C. albicans* and *C. tropicali*.⁽³⁾⁽⁴⁾⁽⁸⁾ Some components of volatile oils viz. Myrcene and pinene have shown antifungal activity against *Curvularia palliscens*, *Aspergillus niger*, *A. terreus*, *Fusarium moniliforme* and *F. falcatum*.⁽⁴⁾ Antibacterial activity of free and bound phenolics from mango ginger rhizomes has been reported by Siddaraju and Dharmesh (2007). Both free and bound phenolic fractions of mango ginger are effective in inhibiting H⁺, K⁺-ATPase activity and Helicobacter pylori growth.⁽⁸⁾ A novel and natural antibacterial compound (difurocumenonol), recently isolated from mango ginger, has high antibacterial activity against a wide spectrum of bacteria, including Gram-negative and Gram-positive bacteria. (e.g. *Pseudomonas aeruginosa*, *Salmonella typhi*, *Klebsiella pneumoniae*, *Enterobacter aerogenes*, *Yersinia enterocolitica*, *Micrococcus luteus*, *Staphylococcus aureus*, *Enterococcus fecalis*, *Bacillus cereus*, *Bacillus subtilis* and *Listeria monocytogenes*).⁽¹⁾ On the basis of its wide range of activity, difurocumenonol and mango ginger extracts can potentially be used as natural food preservatives to control the growth of foodborne pathogens and as a source of mango flavor (Policegoudra *et al.*, 2006)...⁽⁴⁾ The essential oils of *C. amada* were also studied for their antimicrobial activity against certain Gramnegative (*Vibrio cholerae* [*Vibrio comma*] *etc.* and Gram-positive (*Staphylococcus aureus*, *Corynebacterium diphtheriae* and α -hemolytic *Streptococcus*) organisms using the agar cup-plate method.⁽⁹⁾ The well diffusion method was used to determine the antibacterial activity of the extract prepared from the *Curcuma amada* using standard procedure of Bauer *et al.*⁽¹⁰⁾

Antimicrobial activities of *C.amada*⁽¹⁾

S. No.	Type of extract	Microbes
1	Aqueous extract	E.Coli, B.Subtilis, S.aureus
2	Phenolic fractions	Helicobacter pylori
3	chloroform extract	B. cereus, B. subtilis, Micrococcus luteus, Staphylococcus aureus, Listeria

		monocy- togenes, Enterococcus fecalis and Salmonella typhi
4	Acetone extract	Micrococcus luteus, Listeria monocytogenes,
5	Volatile oil	Curvularia palliscens, Aspergillus niger, A. ter- reus, Fusarium moniliforme and F. falcatum.
6	Rhizomes essential oil	P.aeruginosa M. luteus, S.aureus,, E. coli, S. typhi, E. fecalis, B. subtilis, B. cereus K. pneu- moniae, Y. enterocolitica, E. aerogenes, P. mirabilis, and L. monocytogenes.
7	Rhizome of mango ginger	S. aureus, S. typhi, S. dysen- teriae, P. aeruginosa, P. mirabilis, C. albicans and C. tropicali.

Antioxidant Activity:

Plants with antioxidant activity are useful in pharmaceutical industries for the preparation of new drugs.⁽¹¹⁾ Antioxidant properties of plant are due to the presence of phenolic or flavonoid components The presence of curcumin and curcuminoids might be responsible for antioxidant activity ⁽³⁾ .Free radical scavenging activity of the extracts was evaluated by hydrogen donating ability using stable radical DPPH. The ability of the extracts to neutralize hydroxyl radical was expressed as 50% inhibitory concentration (IC50) in µg/ml.⁽¹²⁾ In a comparative study, the antioxidant activity of different plant parts of *C. amada* and other *Curcuma* species was investigated, with the main emphasis on leaves and rhizomes. The rhizomes of *C. amada* (45 µg 1.6%; antioxidant activity relative to the control at 2 mg/40 µL concentration) were relatively less effective as antioxidants than the leaves (51 µg 2%; Niranjana *et al.*,2003).⁽⁹⁾⁽¹¹⁾ Policegoudra *et al.* (2007) reported different antioxidant activity assays like DPPH radical scavenging activity, superoxide radical scavenging activity, metal chelating activity and lipid peroxidation activity.⁽¹⁵⁾ Among hexane, chloroform, ethyl acetate, acetone and methanol extracts, ethyl acetate and acetone extracts showed good DPPH radical scavenging activity.⁽⁸⁾ Antioxidant capacity of different extracts was estimated by scavenging diphenyl picryl hydrazyl (DPPH), nitric oxide (NO) and hydrogen peroxide.⁽¹²⁾

ANTIOXIDANT POTENTIAL OF DIFFERENT EXTRACTS OF MANGO GINGER RHIZOME.

Sl. No.	Mango ginger extracts	% Antioxidant potential
1	Dichloromethane	39.22
2	Ethyl acetate	52.65
3	Methanol	66.08
4	Aqueous	36.75
5	Gallic acid (Stand.) ⁽¹³⁾	95.75

DPPH Radical Scavenging activity:

DPPH is a well known radical to monitor chemical reactions involving radicals and recently it is most widely used for antioxidant assay.⁽¹³⁾ When a solution of DPPH having a strong absorption at 517 nm is

mixed with that of a substance that can donate a hydrogen atom, then this gives rise to the reduced form of DPPH which can be monitored by measuring the absorbance at 517 nm. Lower absorbance at 517 nm represents higher DPPH scavenging activity.⁽¹⁴⁾ Radical scavenging activity was measured by using DPPH scavenging method of (Blois, 1958).⁽¹⁾ A solution of DPPH in methanol (24µg/ml) was prepared and 2ml of this solution was added to oil at different concentrations (10- 40µg/ml).⁽⁶⁾ Absorbance at 517 nm was determined after 30 min at room temperature and the scavenging activity were calculated as a percentage of the radical reduction.⁽¹⁴⁾ Each experiment was performed in triplicate. Ascorbic acid was used as reference compound.⁽¹⁵⁾

Some other uses of *C. amada*:

Curcuma amada also use as Antifungal, Anti-inflammatory, Platelet aggregation inhibitory, Cytotoxicity, Antiallergic, Biopesticide, Hypotriglyceridemic, Brine-shrimp lethal, CNS depressant and analgesic, Enterokinase inhibitory activity and antitubercular.⁽⁸⁾

CONCLUSION:

Mango ginger (*Curcuma amada* Rox) is an annually growing plant and belongs to family Zingiberaceae. It has been cultivated throughout the world and used for thousands of years for food flavoring, essential oil applications and in traditional uses.⁽¹⁴⁾ In recent years, many possible sources of natural antibiotics have been in use for several infectious diseases.⁽⁶⁾ Considering the high costs of the synthetic drugs and their various side effects, the search for alternative products from plants used in folklore medicine is further justified.⁽¹⁾ The currently available drugs in the allopathic system of medicine are not so effective in combating a wide variety of complications. The remedial measure may lie in the phytochemicals.⁽⁴⁾ Mango ginger appears to be highly potential and had remained unexplored for their bioactive phytochemicals.⁽¹³⁾ An array of phytochemicals like phenolics, terpenoids and other bioactive constituents were reported in mango ginger rhizome.⁽¹¹⁾ They were recognized for various biological activities such as antimicrobial, antioxidant, anticancer, anti-inflammatory, antidepressant, antitubercular and platelet aggregation inhibitory activities.⁽⁸⁾

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