REVIEW ARTICLE

Pharmacological activities of *Curcuma caesia*

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Curcuma caesia Roxb. is a perennial, erect rhizomatous herb with large leaves. Fresh rhizomes are aromatic with intense camphoraceous odour, cultivated for its rhizomes, which are used in traditional medicine. The plant is reported to contain camphor, ar-turmerone, (*Z*)-ocimene, ar-curcumene, 1, 8-cineole, elemene, borneol, bornyl acetate and curcumene as the major constituents. The plant has been reported to have antifungal activity, anti-asthmatic, smooth muscle relaxant, antimicrobial activity, antioxidant activity, analgesic, locomotor depressant, anticonvulsant and muscle relaxant effects, anti-inflammatory properties. It is now considered as a valuable source of unique natural products for development of medicines against various diseases. This review gives a view mainly on the meditional uses, phytochemistry and pharmacological actions of the plant.

Key words: Black turmeric, *Curcuma caesia*, Kali Haldi, meditional use, pharmacological activity

INTRODUCTION

Indian Medicinal plants are considered a vast source of several pharmacologically active principles and compounds, which are commonly used in home remedies against multiple ailments.[1]

The genus *Curcuma* is a well-known spice of India. It is also called Haldi and more than 200 species and subspecies of it is found all across the world. One of which is *Curcuma caesia* Family: Zingiberaceae. It is also known as "Kali Haldi." It is an erect rhizomatous herb with large leaves. Fresh rhizomes are aromatic with intense camphoraceous odour and are applied externally to sprain and bruises.[2]

Black Turmeric (*C. caesia*) is native to North-East and Central India. It is also sparsely found in Papi hills of East Godavari, the root hills of the Himalayas and North Hill forest of Sikkim. The rhizomes of Black Turmeric have a high economic importance owing to its putative medicinal properties. The rhizomes are used in the treatment of hemorrhoids, leprosy, asthma, cancer, epilepsy, fever, wound, vomiting, menstrual disorder, smooth muscle relaxant activity,[3] anthelmintic, aphrodisiac, inflammation, gonorrheal discharges, etc.[3,4] Almost all species of Curcuma contains antioxidant activity and the pharmacological effects and prospects for future clinical use had been tried so far.[5]

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TAXONOMICAL HIERARCHY

Kingdom: Plantae
Subkingdom: Viridaeplantae
Phylum: Tracheophyta Sinnott
Subphylum: Euphyllophytina
Class: Magnoliopsida
"monocotyledons"
"commelinids"
Order: *Zingiberales*
Family: *Zingiberaceae*
Subfamily: *Zingiberoideae*
Tribe: *Hedychieae*
Genus: *Curcuma*
Species: *C. caesia* Roxb

Vernacular Names

In different parts of India *C. caesia* is known by different names.
Hindi: Kali Haldi, Nar Kachura Krishna Kedar
Manipuri: Yaingang Amuba or Yaimu
Marathi: Kala-haldi
Telugu: Nalla Pasupu
Kannada: Kariarishina, Naru Kachora
Bengali: Kala Haldi
Mizo: Aihang, Ailaihang
Assamese: Kala Haladhi
Nepalese: Kaalo Haledo

Distribution

Mostly found in Bengal and north-eastern part of the country including Arunachal Pradesh, Meghalaya,

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Mizorum. It is also found in some parts of central India like Raipur, Mandla, Amarkantak, Panchamarhi etc.[6]

MORPHOLOGY

The plant is usually erect ranging from 0.5 m to 1.0 m in height; it is differentiated into underground large ovoid tuberous rhizome often called root-stock and an erect aerial shoot with leaves and flowers [Figures 1 and 2].[7]

Rhizome

The rhizome is tuberous with camphoraceous sweet odor, about 2-6 cm in diameter, the shape and size is often variable. It is sessile, laterally flattened, and covered with adventitious roots, root scars, and warts; moreover, it shows longitudinal circular wrinkles on the surface giving the look of nodal and inter-nodal zones to the rhizome. The surface (cork) of rhizome is dark brown, bluish black, or buff in colour; it shows circular arrangements of remnants of scaly leaves, which gives a false impression of growth rings. The branching is more or less sympodral.[7]

Root

As the plant propagates with rhizome, the primary roots are not noticed; however, yellow brown long fibrous and tapering adventitious roots are found all over the surface of rhizome.[7]

Leaves

The leaves are in the groups of 10-20, each leaf is broad oblong lanceolate and glabrous. In the middle region, the lamina shows deep farraginous purple coloured clouds. The petiole is ivory colour and unsheathing the petioles encircle each other forming a pseudoaxis. The variation is parallel, typical characteristic of monocots.[7]

Inflorescence

It is 15-20 cm long dense spike, which arises much before the opening of leaf, the bracts are green, and the bracts of coma are deep red, which become crimson when old.[7]

Flowers

Smaller than bracts, pale yellow with reddish border. Calyx: 10-15 mm long, obtuse, 3 toothed, and Corolla: Long tubular, pale yellow lip-3 lobed semi-elliptic.[7]

BIOACTIVE COMPONENTS IN *C. CAESIA*

C. Caesia contain maximum curcuminoids, oil content, flavonoids, phenolics, different important amino acids, protein and high alkaloid content which reveals that the presence of these bioactive secondary metabolites correlates with the medicinal uses of *C. Caesia* as fragrances, flavouring and many important useful pharmaceutical products [Table 1].[8]

Figure 1: *Curcuma caesia*

Figure 2: Dried rhizomes of *Curcuma caesia*

Table 1: Content of volatile oil, total curcuminoids and other bioactive components in *Curcuma caesia*

Parameters	Content in the rhizomes
Total curcuminoid (mg/g dry wt.)	78.4±0.06
Volatile oil content (% v/w)	6.75±1.12
Total phenols (mg/g dry wt.)	60±0.03
Flavonoids (mg/g dry wt.)	30±0.06
Alkaloids (mg/g dry wt.)	104.25±1.66
Soluble protein (mg/g fresh wt.)	47.5±1.9

The research on the volatile oil of *C. caesia* rhizomes resulted in the identification of 30 components, representing 97.48% of the oil, with camphor (28.3%), ar-turmerone (12.3%), (*Z*)-ocimene (8.2%), ar-curcumene (6.8%), 1, 8-cineole (5.3%), elemene (4.8%), borneol (4.4%), bornyl acetate (3.3%) and curcumene (2.82%) as the major constituents.[9]

PHARMACOLOGICAL ACTIVITY

Medicinal uses of the rhizome arise from the bioactive components. Bioactive components such as curcuminoids

are responsible for anti-oxidative and anti-inflammatory properties, wound healing, hypoglycemia, anti-coagulant, anti-microbial activities.[1] Curcuminoids exhibit free radical scavenging property[10] and anti-oxidant activity.[11] Main bioactive substances in the rhizomes are due to curcumin and two related demethoxy compounds, demethoxycurcumin and bisdemethoxy curcumin. Flavonoids and phenolic compounds which are widely distributed in plants have been reported to exert multiple biological effects including antioxidant, free radical scavenging abilities, anti-inflammatory, anti-carcinogenic etc.[12]

Anti-fungal Activity

Banerjee and Nigam, 1976 reported antifungal activity in *C. caesia* rhizomes. Essential oil of rhizomes of *C. caesia* Roxb has been known for its antifungal activity.[13]

Smooth Muscle Relaxant and Anti-asthmatic Activity

Arulmozhi *et al.* (2006) evaluated anti-asthmatic property of *C. caesia*. The hydroalcoholic extract of *Curcuma caesia* (CC extract) was tested for its relaxant effect in guinea pig trachea and also in the presence of various receptor antagonists and enzyme inhibitors. Furthermore, the possible role of hydroalcoholic extract in calcium channel modulation was investigated in depolarized rabbit aorta. The CC extract concentration dependently relaxed the carbachol (1 μM)-induced pre-contractions and the presence of an antagonist, such as propranalol, glibenclamide, 2′, 5′-dideoxyadenosine, α-chymotrypsin, L-NNA and methylene blue, did not affect the log concentration relaxing response curves of cumulative CC extract to carbachol (1 μM)-induced pre-contraction.[4]

Pritesh Paliwal *et al.* (2011) investigated the bronchodilating activity of extracts of *C. caesia*. Bronchodilator activity of the extract was studied on the histamine aerosol induced Bronchospasm and pre-convulsion dyspnoea in guinea pigs. Treatment with methanolic CC extract 500 mg/kg showed significant protection against histamine induced bronchospasm. In this study CC extract significantly prolonged the latent period of convulsions followed by exposure to histamine aerosol at the dose of 500 mg/kg and showed maximum protection of 34.84% at 4th h as compared to chlorpheniramine maleate (standard) 2 mg/kg, p.o. which indicating its H1 receptor antagonistic activity and supports the anti-asthmatic properties of the plant.[14]

Anti-oxidant Activity

Chirangini *et al.*, (2004), Rhizome extracts of some members of the medicinal *Zingiberales* are widely used in dietary intake as well as in the traditional system of medicine. Curcumin, the chrome orange-yellow colouring compound present in turmeric rhizomes, has long been known to possess antioxidant property. Chirangini evaluated Crude methanol extracts of the rhizomes of 11 species, including *C. caesia* for their antioxidant properties using sulphur free radical reactivity with curcumin as a reference indicator, *C. caesia* gave good degree of radioprotection.[15]

Mohit Mangla *et al.* (2010) investigated the anti-oxidant activity of methanolic extract of rhizomes of *C. caesia* using DPPH (1,1-diphenyl-2-picrylhydrazyl) free radical scavenging assay. The IC 50 (Inhibitory concentration) was calculated by plotting graph between the percentages of inhibition versus concentration. The IC 50 value of extract and Butylated Hydroxytoluene was found to be 862.35 μg and 46.25 μg for 2 ml of 500 μM concentration of DPPH. This suggests that methanolic CC extracthad moderate IC 50 value as compared to Butylated Hydroxyltoluene.[16] Krishnaraj *et al.*, (2010) were determined phenol content and antioxidant activity of *C. caesia* in comparison with *Curcuma amada*. The total phenol contents of the methanolic rhizome extracts of *C. amada* and *C. caesia* were 37.64 mg and 44.33 mg Tannic acid equivalents/g dry material, respectively. The reducing power and superoxide, ABTS [2,2′-azino-bis (3-ethylbenzothiazoline-6-sulphonic acid)] and DPPH radical scavenging activities of *C. caesia* were higher than *C. amada*. These results supported that the non-conventional *C. caesia* could be an economically.[17] Indrajit Karmakar *et al.* (2011) studied the methanolic CC extractrhizome for some *in vitro* antioxidant activity. Effect of methanol extract of *Curcuma caesia* rhizome (MECC) on ROS (Reactive Oxygen Species) and RNS (Reactive Nitrogen Species) were evaluated *in vitro* methods like 1, 1-diphenyl-2-picrylhydrazil radical, hydroxyl radical, superoxide anion, nitric oxide, hydrogen peroxide, peroxynitrite and hypochlorus acid. Lipid peroxidation, total phenolic content was also measured by standard assay method. The extract show significant antioxidant activity in dose dependent manner.[18]

Analgesic Activity

Satija Saurabha *et al.*, (2011) compared the analgesic and antipyretic activity of different extracts obtained from *C. caesia* and *C. amada* rhizomes. Analgesic and antipyretic activities of the plant extracts was evaluated using chemical model of acute pain and brewer's yeast induced hyperthermia in rats. The writhing and pyrexia were observed at the doses of 250 and 500 mg/kg body weight of rats. Both the plants exerted analgesic and antipyretic activity. Where by *C. amada* showed better response in comparison to *C. caesia*.[19]

Locomotor Depressant, Anti-convulsant and Muscle Relaxant Effects

Indrajit Karmakar *et al.* (2011) evaluated the MECC for some neuropharmacological activities like analgesic,

Locomotor, Anticonvulsant property and muscle relaxant effect in experimental animal models. The results of acetic acid induced writhing showed significant inhibition of writhes, at both test doses as compared with control group in a dose dependent manner. In tail flick test MECC at the both doses exhibited significant increase in reaction time of mice. In locomotor activity study, it was found that MECC significantly depressed the locomotor activity in mice in a dose dependent fashion. In anticonvulsant evaluation MECC pre-treatment exhibited significant and dose dependent protection from PTZ-induced convulsions in mice by delaying the onset of convulsions and recovering the animals leading to survival. In muscle relaxant study, the MECC significantly and dose dependently decreased the fall off time in mice demonstrating its muscle relaxant property.[20]

Anxiolytic and CNS Depressant Activity

Indrajit Karmakar *et al.* (2011) evaluated the MECC rhizome for Central Nervous System (CNS) depressant activities. MECC was studied for Hypnotic activity, Forced swim test and Tail suspension test. MECC (50 and 100 mg/kg; i.p.) produced significant and dose dependent reduction in the onset and prolongation of sleep duration induced by pentobarbitone. MECC on immobility period in both FST and TST at the doses of 50 and 100 mg/kg, i.p for 7 successive days to mice decreased the immobility periods significantly in a dose dependent manner, indicating significant antidepressant like activity.[3]

Anthelmintic Activity

Gill Randeep *et al.* (2011) studies two most popular species of genus Curcuma, *C. amada* and *C. caesia* were proved for their anthelmintic activity. In this study, four extracts viz. Petroleum ether, Dichloromethane, ethanol and aqueous extract of rhizomes of *C. amada* and *C. caesia* were investigated for anthelmintic activity at three different concentrations. Three concentrations (50 mg/ml, 100 mg/ml and 150 mg/ml) of each extract were studied which included the determination of paralysis time and time of death of earthworms. All the extracts of both the plants exhibited dose dependant activity. The results indicated that ethanol extract (150 mg/ml) of *C. caesia* was most effective in causing paralysis of earthworms, while the ethanol extract (150 mg/ml) and Dichloromethane extract (150 mg/ml) of both Curcuma species were very effective in causing death of earthworms.[21]

Anti-bacterial Activity

Angel Gabriel Rajamma *et al*. (2012) investigated antioxidant and antibacterial activities of oleoresins isolated from nine *Curcuma* species. Oleoresins were extracted from rhizomes of nine starchy *Curcuma* species (*Curcuma aeruginosa, C. amada, Curcuma aromatica, Curcuma brog, C. caesia, Curcuma malabarica, Curcuma rakthakanta, Curcuma sylvatica* and *Curcuma zedoaria*) using dichloromethane and evaluated for antioxidant and antibacterial activity. Oleoresins from all the species exhibited high DPPH radical scavenging activity and ferric reducing power, which had good correlation with phenolic content The oleoresins inhibited both g +ve (*Staphylococcus aureus* and *Bacillus subtilis*) and g –ve (*Escherichia coli*) bacteria. Maximum sensitivity was observed in the case of *B. subtilis*. The results indicated that the oleoresins from these species (most of which are unutilized) would have good potential as additives for food and medicinal applications.[22]

Anti-ulcer Activity

Pranab KR Bordoloi *et al*. (2012) studied the anti-ulcer activity of the ethanolic extract of the rhizome of *C. caesia* on experimental animal models. Four groups of albino rats weighing 150-200 g were taken for the study (n = 5). Group A: Control (3%gum acacia 5 ml/kg/day orally for 7 days). Group B: Experimental control (Aspirin 400 mg/kg orally as single dose on 7th day). Group C: Test (*C. caesia* extract 500 mg/kg/day orally for 7 days plus Aspirin 400 mg/kg orally on 7th day) and Group D: Standard (Ranitidine150 mg/kg orally for 7 days and Aspirin 400 mg/kg orally on 7th day). The stomachs of the sacrificed rats were removed. The ulcer index, pepsin activity, free and total acidity and volume of gastric juice in group III and IV showed significant decrease in comparison to group II whereas there was increase in gastric mucus secretion.[23]

CONCLUSION

C. caesia is widely distributed throughout India. The plant appears to have a broad spectrum of activity on several ailments. Rhizomes of the plant have been explored for antifungal activity, smooth muscle relaxant and anti-asthmatic activity, antioxidant activity, analgesic activity, locomotor depressant, anticonvulsant and muscle relaxant effects, anxiolytic and CNS depressant activity, anti-bacterial activity, anti-ulcer activity and many other miscellaneous activities. The pharmacological studies reported in this review confirm the therapeutic value of *C. caesia*. However, less information is available regarding the clinical, toxicity, and phytoanalytical properties of this plant. Several phytochemical studies have been reported but still it needs to progress. With the availability of primary information, further studies can be carried out like clinical evaluation, phytoanalytical studies and toxicity evaluation. The plant is pre-clinically evaluated to some extent; if these claims are scientifically evaluated clinically, then it can provide good remedies and help the mankind in various ailments.

REFERENCES

1. Chatopadhyay I, Biswas K, Bandhopadhyay U, Banerjee RK. Turmeric and Curcumin: Biological actions and medicine of applications. Curr Sci 2004;87:44.

2. Wealth of India: A Dictionary of Indian Raw Materials and Industrial Products. Vol. 2. New Delhi: National Institute of Science Communication and Information Resources, CSIR; 2001. p. 264.
3. Karmakar I, Dolai N, Bala A, Haldar PK. Anxiolytic and CNS depressant activities of methanol extract of *Curcuma caesia* rhizome. Pharmacologyonline 2011;2:738-47.
4. Arulmozhi DK, Sridhar N, Veeranjaneyulu A, Arora SK. Preliminary mechanistic studies on the smooth muscle relaxant effect of hydroalcoholic extract of *Curcuma caesia*. J Herb Pharmacother 2006;6:117-24.
5. Miquel J, Bernd A, Sempere JM, Díaz-Alperi J, Ramírez A. The curcuma antioxidants: Pharmacological effects and prospects for future clinical use. A review. Arch Gerontol Geriatr 2002;34:37-46.
6. Mishra M. Harvesting practices and management of two critically endangered medicinal plants in the natural forests of central india. FAO Corporate Document Repository. 2003. Available from: http://www.fao.org/DOCREP/005/Y4496E/Y4496E33.htm. [Last cited on 2013 Feb 20].
7. Paliwal P, Pancholi SS, Patel RK. Pharmacognostic parameters for evaluation of the rhizomes of *Curcuma caesia*. J Adv Pharm Technol Res 2011;2:56-61.
8. Sarangthem K, Haokip MJ. Bioactive components in *Curcuma caesia* roxb. Grown in Manipur. The bioscan 2010;1:113-15.
9. Pandey AK, Chowdhary AR. Volatile constituents of rhizome oil of *Curcuma caesia* Roxb. from central India. Flavour Frag J 2003;18:463.
10. Song EK, Cho H, Kim JS, Kim NY, An NH, Kim JA Diarylheptanoids with free radical scavenging and hepatoprotective activity *in vitro* from Curcuma longa. Planta Med 2001;67:876-7.
11. Jayaprakasha GK, Rao LJ, *Sa*kariah KK. Antioxidant activities of curcumin, demethoxycurcumin and bisdemetho*x.* Food Chem 2006;98:720-724.
12. Miller AL. Antioxidant flavonoids: Structure, function and clinical usage. Alt Med Rev 1996;1:103-111.
13. Banerjee A, Nigam SS. Antifungal activity of the essential oil of *Curcuma caesia* Roxb. Indian J Med Res 1976;64:1318-21.
14. Paliwal P, Pancholi SS, Patel RK. Comparative evaluation of some plant extracts on bronchoconstriction in Experimental animals. AJPLS 2011;1:52-7.
15. Chirangini P, Sharma GJ, Sinha SK. Sulfur free radical reactivity with curcumin as reference for evaluating antioxidant properties of medicinal *Zingiberales*. J Environ Pathol Toxicol Oncol 2004;23:227-36.
16. Mangla M, Shuaib M, Jain J, Kashyap M. *In-vitro* evaluation of antioxidant activity of *Curcuma caesia* roxb. Int J Pharm Sci Res 2010;1:98-102.
17. Krishnaraj M, Manibhushanrao K, Mathivanan N. A comparative study of phenol content and antioxidant activity between non-conventional *Curcuma caesia* Roxb. and *Curcuma amada* Roxb. Int J Plant Prod 2010;4:169-74.
18. Karmakar I, Dolai N, Bala A, Saha P, Sarkar N, Haldar PK. Scavanging activity of *C. caesia* rhizome against reactive oxygen and nitrogen species. Orient Pharm Exp. Med Springer 2011;221-28.
19. Kaur R, Satija S, Kalsi V, Mehta M, Gupta P. Comparative study of analgesic and antipyretic activity of *Curcuma caesia* and *Curcuma amada* roxb. Rhizomes. Inventi Impact: Ethnopharmacology, Vol. 2011, Article ID- "Inventi: Ep/441/11", 2011. Available from: http://www.inventi.in/Article/ep/441/11.aspx. [Last cited on 2013 Feb 20].
20. Karmakar I, Saha P, Sarkar N, Bhattacharya S, Haldar PK. Neuropharmacological assessment of *Curcuma caesia* Roxb. Rhizome in experimental animal models. Orient Pharm Exp Med Springer 2011;11:251-55.
21. Gill R, Kalsi V, Singh A. Phytochemical investigation and evaluation of anthelmintic activity of *Curcuma amada* and *Curcuma caesia*-a comparative study. Inventi Impact: Ethnopharmacology vol. 2011. Article ID-"Inventi: ep/412/11", Available from: http://www.inventi.in/Article/ep/412/11.aspx. [Last cited on 2013 Feb 20].
22. Rajamma AG, Bai V, Nambisan B. Antioxidant and antibacterial activities of oleoresins isolated from nine *Curcuma* species. Phytopharmacology 2012;2:312-7.
23. Das S, Bordoloi PK, Phukan D, Singh S. Study of the anti-ulcerogenic activity of the ethanolic extracts of rhizome of *Curcuma caesia* (eecc) against gastic ulcers in experimental animals. Asian J Pharm Clin Res 2012;5:200-3.

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