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NEW MEDICO-ETHNO-BOTANICAL REPORT OF *ALPINIA GALANGA* WILL. (ZINGIBERACEAE) USED BY CHAKMA TRIBE FROM TRIPURA IN NORTH EAST INDIA

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ABSTRACT:

A new medico-ethno-botanical report of *Alpinia galanga* Will. (Zingiberaceae) used by Chakma tribe from Tripura in North east India is presented in the communication for the treatment of painful menstruation and at the time of child birth to induce labour pain in case of inadequate labour pain and to promote expulsion of placenta in case of retain placenta. The claim is new in relation to reporting and enlightened a new direction for ethnopharmacological validation since rhizome of the plant have already reported for various ethnobotanical uses from North east India and pharmacological activities such as antifungal, antileishmanial, antimicrobial, antigiardial, antidermatophytic, antidiabetic, antiamoebic, antimalarial, anticancerous, anti-inflammatory, antiallergic, antioxidant, antibacterial and neuroprotective activities. But none of the reports available is corroborative to the present claim which is supported by field observation. Comprehensive review of reported ethnobotany and ethnopharmacology is done to justify the uniqueness of the present claim.

KEY WORD: *Painful menstruation, inadequate labour pain, retain placenta, Chakma tribe, Tripura.*

INTRODUCTION:

Plant-derived drug research has become more promising in recent years and also a better alternative for synthetic medicine and therapeutics in spite of many challenges (Vanwyk and Wink 2009). Nearly, 21,000 plants have been listed by the World Health Organization (WHO), which are in use for diverse medicinal purposes around the world. Being the largest producer of medicinal herbs, India is known as the botanical garden of the world catering to the needs for herbal medicines (Seth and Sharma 2004). The WHO report revealed that around 80 % of world population depends on the traditional medicines, largely on plant-derived drugs towards their healthcare, among which 30 % of currently used therapeutics are from natural resources alone. Owing to the increasing cultural acceptability and significantly lower side effects, nearly 75–80 % of the whole population in the developing countries mostly prefers the herbal treatment for primary health care (Ghasi et al. 2000).

Ethnopharmacogological knowledge towards the scientific investigation of medicinally important plants augments the prospects of alternative medicine and therapeutic values. The ethnomedical practices of the tribal communities of North East India were critically studied and documented for the Zingiberaceae family towards their future pharmacological diagnostics (Tushar et al. 2010; Bora and Nath 2011). This important family is distributed worldwide with about 50 genera and 1,300 diverse species mainly concentrating in South and Southeast Asia (Wu and Larson 2000). In India, about 22 genera and 178 species have been reported from North Eastern and peninsular region (Jain and Prakash 1995), whereas North East region alone harbours 19 genera and close to about 88 diverse species (Prakash and Mehrotra 1995).

The largest genus of the family Zingiberaceae, *Alpinia*, was classified by Charles Plumier, the famous French botanist and named after Prospero Alpino, the well-known Italian botanist of sixteenth century. The genus, *Alpinia* belongs to the flowering plants group (angiosperms); as per the Angiosperm Phylogeny Group II (APG II) system, it comes under the umbrella of monocotyledonous plants, belonging to the order Zingiberales, subfamily Alpinioideae and tribe Alpinieae (Ghosh and Rangan 2013). The genus includes 230–250 species distributed throughout tropical and subtropical climates of Asia and the Pacific. DNA-based studies showed the genus as polyphyletic represented by six clades scattered across the tribe Alpinieae (Kress et al. 2005). *Alpinia galanga* Willd. is distributed in the Himalayas and Southern region of Western Ghats (Khare 2007). The species is known as Greater galangal and have various names in Ayurvedic system of medicine as Kulanjana, Sthuulagranthi, Sugandhaa, Ugragandhaa, Malaya Vachaa and Mahaabhari-Vachaa. The same is locally known as Paalik or Paale by the Chakma tribe; Ai-chal by the Mizos and Kurchi vaca by the Tripuri plain tribes and Bengalis.

The plant is a rhizomatous, perennial herb, and attains a height of about 1.5–2.5 m. The rhizome is very prominent and aromatic. Externally, it is reddish brown-white and internally reddish-white. Leaves are leathery, about 30–60 cm long and 10–15 cm, glossy on both surfaces, lanceolate and smooth, with white

margins. Flowers are greenish-white, about 3 cm long, and occur in dense panicles. Corolla has distinctly clawed lips. Flowering occurs in May and June, while fruiting occurs in August and September. Fruits are orange-red in colour. The plant can be successfully cultivated only on sandy loam soils and in humid tropical climate. It can be grown in open sunny areas with sufficient rainfall. With adequate irrigation provisions, it can be grown upto an altitude of 1000 m. (NMPB 2008).

Rhizome of the plant is carminative (in dyspepsia), stomachic, circulatory stimulant, diaphoretic and anti-inflammatory. Throughout southern India, the rhizome of *Alpinia galanga* is used as *Raasnaa* for rheumatism, intermittent fever, dyspepsia and respiratory ailments. EtOH extract of the plant shows anti-inflammatory activity. The ethanolic extract also showed significant antiulcer activity in rats, which has been attributed to the antisecretory and cytoprotective properties of the plant. Major constituents of the essential oil are methyl cinnamate, cineole and d-pinene. In moderate doses, the oil exhibits antispasmodic action. Unani physicians use *A. galanga* as a sex tonic. In mice, the drug caused a significant gain in theweight of sexual organs and increased sperm motility and sperm count. Ayurvedic system of medicine prescribed powder dose of rhizome in 1-3 g. and decoction of rhizome in 50-100 ml. (Khare 2007). Rhizome oil reported from North east India contains 1,8-cineol (67.5%), β-sesquiphellandrene (9.4%), β-pinene (2.3%) and terpinen-4-ol (2.1%) (Dutta & Nath 2003).

STUDY AREA:

Tripura is India's third smallest hilly state, located in the North-eastern part of the country. It is bordered on the North, West and South by Bangladesh, on the East by the state Mizoram and on the North-East by the state Assam. Tripura state lies between 22°56′ to 24°32′ North latitude and between 90°09′ to 92°20′ East longitudes covering an area of 10,491 sq. km. The state is sub-divided into four districts North, Dhalai, West and South Tripura districts. The climate is usually hot and humid; temperature ranges from 10-35°C. The maximum humidity is about 88% while the minimum is 40%. State receives an average of 247.9 cm rains within a year. About 63% of the annual rainfall is caused by the South-West monsoon. The soil is laterite in the hills and alluvial in the plains. The forests in the state are mainly tropical evergreen, semi evergreen and moist deciduous and cover 77.18% of total geographical area (Majumdar and Datta 2007). The use of medicinal plants in the traditional system of folk medicine forms as integral part of the culture of the people of the state. In the rural areas, adjoining vast tracts of forest lands, the naturally occurring medicinal plants are used by local Ojhas and traditional healers for treating every day ailments. This traditional system is in place since time immemorial and forms the backbone of the local health system.

The South Tripura District is bounded on the North by Dhalai district and West Tripura District, while on the other sides by international border with Bangladesh. The total geographical area of South Tripura District is 2624 Sq.km which is about 25% of the total state area. About 37.5% of the population in South

Tripura District is scheduled tribe and 17.16% of the population is scheduled caste. Major tribes in the district are: Tripuri, Jamatia, Reang, Chakma and Halam. The tribals as well as the non-tribals residing in the District have a socio-cultural similarity with the tribals and non-tribals of Bangladesh. Language spoken by majority of the population is Bengali while the tribals mainly speak Kakborak.

In Tripura, 19 scheduled tribes are found to dwell, viz. Tripuri, Jamatia, Bhil, Reang, Noatia, Bhutia, Chakma, Chaimal, Garo, Halam, Khasia, Kuki, Lepcha, Lushai-Mag, Munda, Kaur, Orang, Santhal and Uchai (Chakraborty et al. 2012). Chakma tribe is mainly distributed in Assam, Arunachal Pradesh, Meghalaya, Mizoram and Tripura (Sarmah et al. 2008; Chakraborty et al. 2012) within North east India and in Bangladesh and Myanmer outside India. Chakma tribe is thought to be migrated to Tripura in modern times from North east and South west side and they normally have some rare books in old scripts which they inherit and follow to treat ailments by the use of medicinal plants around them.

METHODOLOGY:

Field trips were carried out in various seasons during 2012-2013 in three forest divisions namely Udaipur, Bagafa and Gumti having 14 forest ranges and nearby tribal locations of South Tripura district by the Survey team of the Institute. The survey was conducted by adopting the methodology proposed by Jain & Rao (1977), Jain (1989), Jain & Mudgal (1999) and as per Guideline of Central Council for Research in Ayurvedic Sciences, New Delhi. Characteristic features of the collected plant materials like habit, habitat, flower colour, distribution and occurrence were recorded in field book and their records were maintained. The Medico-ethno-botanical information was also collected by interviewing the local herbal practitioners and elderly persons of the area. Voucher specimens were collected with the help of local practitioners from the nearest forest area. The specimens were properly dried, mounted and preserved after identification using standard local and regional floras (Deb 1983-1989; Hooker 1872-1897; Kanjilal et al. 1934-40; Prain 1963) followed by matching the specimens with the standard pre-identified specimens of the Herbarium of the Botany Department, North Eastern India Ayurveda Research Institute (NEIARI), Guwahati where voucher specimens were finally deposited for further reference.

Reviewing of the genus *Alpinia* showed its incredible biopharmaceutical potentials as evident from earlier published reports and is gaining the attention of researchers from different disciplines. The presence of the bioactive substances such as flavonoids, tannins and terpenes is the key for its therapeutic efficiency.

Till date most of the work has been concentrated in *A. galanga* which contain more bioactive compounds compared to other species in the genera (Janssen and Scheffer 1985; Oonmetta-aree et al. 2006; Khattak et al. 2005; Weerakkody et al. 2011; Rao et al. 2010; Niyomkam et al. 2010). Essential oil extracted from fresh and dried rhizomes of *A. galanga* have potential antimicrobial activities against a range of bacteria, fungi, yeast and parasite. Ethanol extract from rhizome showed cytological modification to *Staphyllococcus aureus* cells by altering outer membrane integrity (Oonmetta-aree et al. 2006). However,

the galangal extract, being hydrophobic in nature, could not inhibit the proliferation of gram-negative bacteria as the extract unable to penetrate the lipopolysaccharide monolayer of outer membrane of the cell wall. Terpinen-4-ol, a monoterpene, purified from the essential oil of fresh galangal rhizomes, showed antimicrobial activity against *Trichophyton mentagrophytes*. Similarly, acetoxychavicol acetate (ACA) isolated from dried rhizomes of *A. galanga*, is potentially active against several bacteria and many dermatophytes (Janssen and Scheffer 1985). Chloroform extracts from *A. galanga* is found to be highly effective with an added desired advantage of less side effects than traditional medicine, viz. metronidazole (Sawangjaroen et al. 2006).

Recently, for the first time antileishmanial phenylpropanoids has been isolated using hexane, chloroform and ethyl acetate extracts of *A. galanga* rhizome (Kaur et al. 2010). Investigation of Nam et al. (2005) on the n-hexane and chloroform extract of *A. galanga* rhizome lead to the isolation of two compounds, viz. 10-(S)-10-acetoxychavicol acetate and p-coumaryl alcohol c-O-methyl ether. Of the two compounds, former showed significant cytotoxic activity against human cancer cell lines like A549 (IC50 = 8.14 lg/mL), SNU638 (IC50 = 1.27 lg/mL), HT1080 (IC50 = 1.2 lg/mL), HL60 (IC50 = 2.39 lg/mL) and HCT116 (IC50 = 1.77 lg/mL). Whereas, the second compound revealed specific activity against SNU638 (IC50 = 1.62 lg/mL).

Natural bioactive compounds and crude hydroalcoholic fractions isolated from the *Alpinia* species like *A. galanga*, *A. zerumbet*, *A. officinarum*, etc., showed potential activities as antiinflammatory and analgesic agent. Aqueous and hydroalcoholic extracts from leaves and rhizomes of above species possesses key factors responsible for antinociceptive (reducing sensitivity to painful stimuli) and antiallergic properties (Ghosh and Rangan, 2013). *A. galanga* has been exhaustively explored towards diverse biological activities in most of the cases among different *Alpinia* species. Recently, chloroform fraction of *A. galanga* has been found as antiamnesic probably due to the presence of 10S-10-acetoxyeuginol acetate as lead compound (Singh et al. 2011a). On the other hand, *A. galanga* ethanol extract shows antiamnesiac effect in Amyloid b induced neurodegeneration (Singh et al. 2011b).

A table (Table 1) is presented below to show the prospective pharmacologically important bioactive fractions / compounds and their bioactivities from different plant parts of *Alpinia galanga* Willd. along with references as described by Ghosh and Rangan (2013).

RESULTS:

A new report on medico-ethnobotany of *Alpinia galanga* Willd. prescribed and used by Chakma tribe of South Tripura district of Tripura is presented. This report was verified in the field by interviewing several women who had already taken the opportunity of the treatment during complains of child birth and in period of menstruation. Local herbal practitioner and traditional healer, Mr. Bhajyadhan Chakma; aged 50

yrs.; resident of Vill- Barobari, Madhuchandra Chakma para; PO- South Takmapara; Dist- South Tripura (Tripura- 799144) had first informed the report.

The report is enumerated in the following table (Table 2) with mode of preparation of the drug and method of administration along with dose against respective complains.

Some other claims which are also prevalent in the area:

1. Aromatic essential oil from rhizome is also used for preservation of dried fish as a common practice within Chakma tribe and used among other tribes of the region.
2. Powder of rhizome is used for joint pains, rheumatism, in bronchitis and in other respiratory problems.

DISCUSSION:

In the current study, it has been observed that rhizome of *Alpinia galanga* are extensively used by traditional healers and local inhabitants, also rhizome is used to get the bioactive compounds and different fractions show remarkable biological efficacy against various biomedical challenges. Detailed examination of the gathered data in *Alpinia galanga* shows that rhizome is the main plant part used for different ailments and function as a unit of various pharmacological investigations, but the present medico-ethnobotanic claim does not corresponds to any pre-reported claim or with any previously reported biological activities which justifies the uniqueness of the present claim.

CONCLUSION:

Detailed account of the diverse utility of *Alpinia galanga* can be addressed, starting with the ethnomedicinal information culminating with exhaustive scientific exploration. However, thorough examination needs to be carried out to see the efficacy and activity of individual component and in combination to explore the synergistic effects, if any as reported in the present communication.

Conflict of interest statement:

The authors declare that there are no conflicts of interests and the collection of medico-ethnobotanical claim is a part of Medico-ethnobotanical Survey Programme of NEIARI, Guwahati under the Annual Action Plan of 2012-13.

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Table 1: List of prospective pharmacologically important bioactive fractions / compounds isolated from rhizome and their bioactivities

Bioactivities	Bioactive fractions / compounds	References
Antifungal	Acetoxychavicol Acetate	Janssen and Scheffer (1985)
	Chloroform extracts	Phongpaichit et al. (2005)
	Ethanolic extract	Ficker et al. (2003)
Treatment against osteoarthritis	p-hydroxycinnaldehyde	Phitak et al. (2009)
anti diabetic, α-Glucosidase activity	Ethanolic extract	Srividya et al. (2010)
Antileishmanial	1'-acetoxyeugenol acetate, hexane, chloroform and ethyl acetate extract	Kaur et al. (2010)
Antimicrobial	D,L-1-Acetoxychavicol acetate	Oonmetta-aree et al. (2006)
	Ethanol extract	Khattak et al. (2005)
Antigiardial	Chloroform extract	Sawangjaroen et al. (2005)
Antidermatophytic	Ethanolic extract	Trakranrungsie et al. (2008)
Protects acne	Ethyl acetate extract (10-acetoxychavicol acetate)	Niyomkam et al. (2010)
Antiamoebic	Chloroform extract	Sawangjaroen et al. (2006)
Antimalarial	Methanol extract	Abdulelah et al. (2010)
Insecticidal	Hexane, dichloromethane, ethyl acetate and ethanol	Sukhirun et al. (2010)
Anticancerous	10S-10-Acetoxychavicol acetate and p-coumaryl alcohol c-O-methyl ether	Nam et al. (2005)
Antiinflammatory	Alcoholic and aqueous extracts	Satish and Dhananjayan (2003)

Bioactivities	Bioactive fractions / compounds	References
	7-(40-Hydroxy-30- methoxyphenyl) -1-phenylhept -4-en-3-one	Yadav et al. (2003)
Antiallergic	10S-10-acetoxychavicol acetate and 10S-10-acetoxyeugenol acetate	Matsuda et al. (2003a, b)
	Acetoxybenzhydrols	Yasuharaa et al. (2009)
Neuroprotective	n-Hexane, chloroform and ethyl acetate	Singh et al. (2011a)
	Ethanolic extract	Singh et al. (2011b)
Antioxidant	Dichloromethane and methanol extract	Vankar et al. (2006)
	Ethanol extract	Singh et al. (2011b)
Antibacterial	10-Acetoxy-chavicol acetate	Weerakkody et al. (2011)
	Methanol, acetone and diethyl ether extracts (rhizome and leaves)	Rao et al. (2010)

Table 2: New medico-ethnobotanical report

Preparation of the drug	Complaint	Treatment and dose
A part of fresh rhizome (weighing approximately 20 gm.) is collected by digging the area and washed with water. The rhizome part is crushed with the help of mortar and pestle and squeezed to extract fresh juice. An iron stick is heated to fire red hot and dipped in the juice extract. Now, the juice is allowed to cool down	Dysmenorrhoea or painful menstruation	Oral administration of the warm juice is prescribed 10 ml per dose thrice a day for 2 to 3 days for relieve in painful menstruation from the day of first menstruation
	Inadequate labour pain and retain placenta during child birth	Oral administration of 10 ml. of the warm juice is prescribed during labour to induce adequate labour pain and to promote expulsion of placenta in complain of retain placenta