

# Current harvesting practices and quality of bach (*Acorous calamus*) L. Rhizomes traded in the market of Dhamtari Chattisgarh, India

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## SUMMARY

The raw material used by Ayurvedic industry is generally procured through market channels and are sometimes found adulterated. The efficient way to determine adulteration is through morphological and organoleptic studies. The objective of this study is to find out prevalent harvesting method of Bach (*Acorous calamus*), malpractices adopted by various stakeholders and ocular analysis of raw (dry) market samples collected from Dhamtari market, Chattisgarh. The observations revealed that rhizomes were collected in the month of October-November at unripe stage from the natural forests. During harvesting, gatherers often collect Kulanjan rhizomes (*Alpinia galanga*) unintentionally, due to similarity in appearance. On the other hand few market traders mix these rhizomes along with genuine material. Unsustainable harvesting also adversely affects the raw material quality. In the present study, major reasons for poor quality are mis-identification of species by gatherers, mixing of old, diseased parts of same species etc. The paper also suggests various ways and means to combat adulteration problems in raw (dry) material trade sector.

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## Key words :

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**B**ach (*Acorous calamus*) L. belongs to family-Araceae also called as Indian sweet flag, is a semi-aquatic, perennial, aromatic herb with creeping rhizomes. It is found growing wild and is also cultivated throughout India, ascending to an altitude of 2,200m in the Himalayas. In the Ayurvedic system of medicine, the rhizomes are considered to possess anti-spasmodic, carminative and anthelmintic properties, and, are used for the treatment of a host of diseases such as epilepsy and other mental ailments, chronic, diarrhea, dysentery, bronchial catarrh, intermittent fevers, glandular and abdominal tumors. They are also used to treat kidney and liver troubles, rheumatism and eczema.

The increase in demand of medicinal plants for the commercial herbal medicine sector led to the indiscriminate and unscientific collection without any consideration for the quality of the material collected. In many cases the immature extraction of fruits, rhizomes, tubers etc. have severely reduced the quality as well as quantity of few medicinal species which are on high demand. Numerous studies on different medicinal species have confirmed the same (Mishra, 2000; Prasad *et al.*, 2002; Mishra and Kotwal, 2003; Mishra, *et al.*, 2003; Mishra and Kotwal, 2007). Premature collection, uprooting of whole plant before fruiting and competition among villagers to collect entire produce are the

main reasons for sharp decline in the availability and production of few medicinal plants in the natural forests. Their study suggests that collection before maturation should not be permitted so as to maintain the raw material quality (Prasad *et al.*, 2002; Prasad *et al.*, 2003).

Misidentification of species and mistaken substitution of herbs may result in unexpected adverse impact on human health. The plant material can be mis identified when wild plants are harvested or at the time of the manufacturers bulk purchase (Chan *et al.* 1993; Vanherweghem *et al.*, 1993; But, 1994; Chan *et al.*, 1994; Fugh-Berman, 2000). One tragic example occurred in Hong Kong when the toxic herb Guijiu, which is derived from the root and rhizome of *Podophyllum hexandrum* was found as an adulterant of herb Longdan cao (*Gentiana rigescens*). Subsequent investigations revealed that the adulteration was made by the supplier in mainland China, but no one in the supply chain noticed the error until the occurrence of the adverse event (Chan *et al.*, 1993). In addition, confusing nomenclature or several terms with common, transliterated, latin and scientific names lead to misidentification. Inadvertent substitution of raw materials may cause adverse effects (Tomlinson *et al.*, 2004;

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Pecker *et al.*, 2004)

At present most herbal raw materials are still harvested or wild crafted under completely uncontrollable conditions (Lange, 2004). Indian Ayurvedic industries generally face the problem of adulteration and substitution at raw material stage. Scientists (Rawat *et al.*, 1996; Shome *et al.*, 1997; Rawat, 2005) observed that in herbal markets of the country, sometimes not only the various species of particular genus but entirely different taxa are being sold under the same vernacular name. The means of adulteration and substitution may be deliberate or sometimes unintentional (Mitra and Kannan, 2007). Occasionally in place of the genuine herbs, substituted species which have similar appearance are deliberately mixed. This generally happens when the required raw (dry) materials are in scarcity (Sunita, 1992). Adulteration in market samples is one of the greatest drawbacks in promotions of herbal products from India (Dubey *et al.*, 2004). Plant samples in the market are stored under undesirable conditions over the years and often contain a mixture of other plant species thus adversely affecting their bioefficacy. The efficacy of many of drugs is fading because of the adulterated, dried raw materials profusely available in the indigenous market. Due to this adulteration

and altered efficacy the faith in crude drug promotion has declined (Gupta *et al.*, 2003; Daniel, 2004; Mishra, 2008).

#### Study area :

Dhamtari is situated between 20° 42' N Latitude and 81° 33' Longitude (Fig. 1). The total area of the district is 2029 Sq. Km. and 305 Meter above sea level. The District is surrounded by District Raipur in North and South, part of Orissa state in East and West. The district is rich in flora especially in terms of medicinal plants and has a variety of species. The dependency of the primary collectors on medicinal plant collection is very high. The entire produce from the villagers are procured by the middleman and are brought to the Dhamtari. There were 12-13 big traders of medicinal plants located in the city. A field survey of the district was done during August 2007 to March 2008, to get an idea about current harvesting practices of Bach rhizomes in the natural forests and other malpractices adopted by traders and other stakeholders. The forest survey and market sample collection was done on the basis season and availability of species in the natural forests. Morphological analysis of samples was also done to find out adulterants present in the samples.

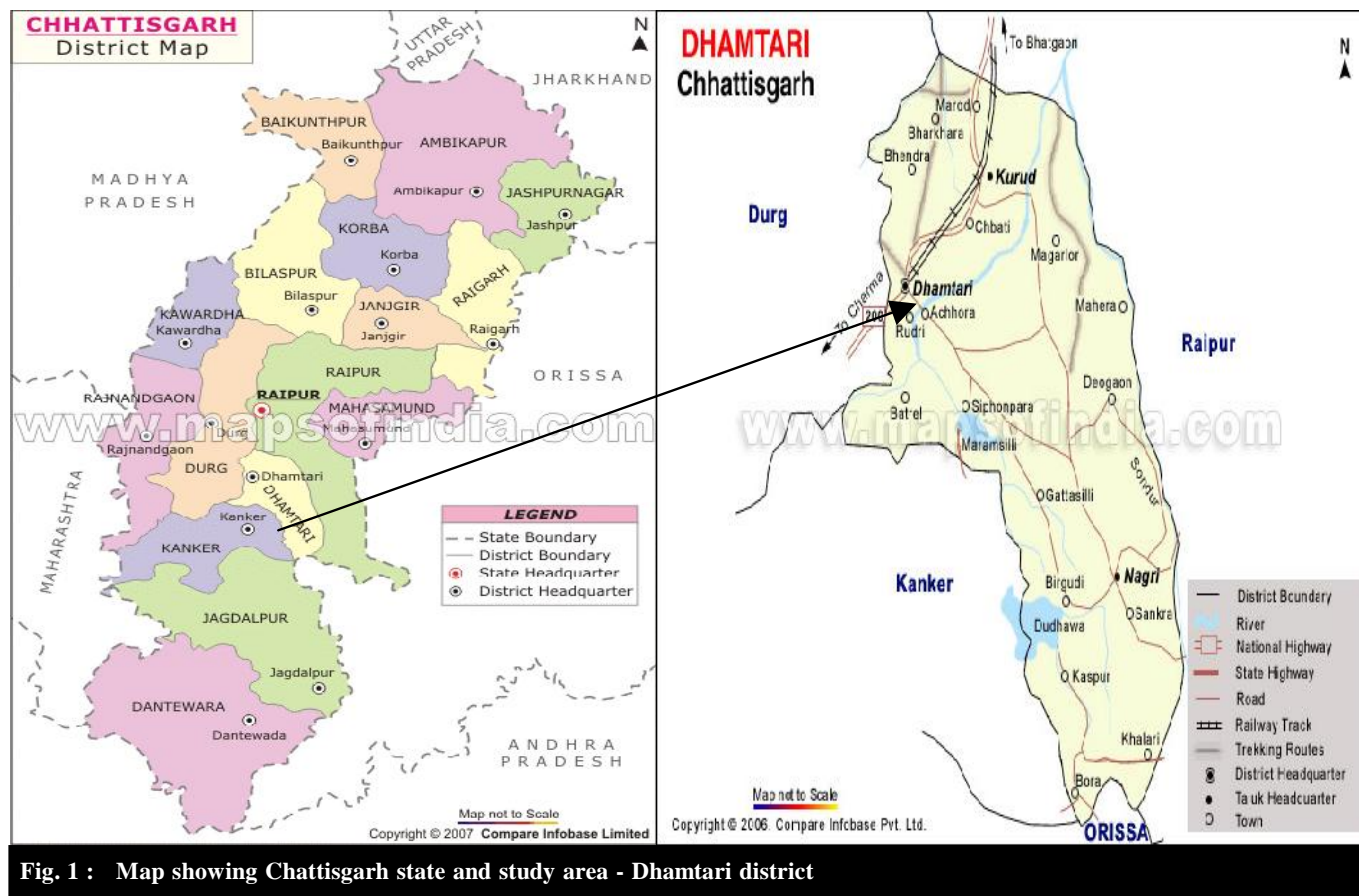


Fig. 1 : Map showing Chattisgarh state and study area - Dhamtari district

## MATERIALS AND METHODS

### *Survey of gatherers (collectors):*

A field survey of Dhamtari forest division was done with the help of semi structured questionnaire. Method adopted by primary collectors to harvest rhizomes from the natural forest was closely examined at the time of harvesting. Total of five forest ranges and five villages in each range (total 25 villages) were selected for collecting data (Table 1). Persons involved (15% House holds) in each forest range were interviewed about the time and method of harvesting, tools used etc.

**Table 1 : Places from where gatherers data and forest (master) and market samples were collected**

Name of Location/place	Name of selected Range/ Villages
Dhamtari Forest Division (Territorial)	Dugli, Jabarra, Kurud, Sihawa, Nagri
Dhamtari market	Sihawa road, Jagdalpur road, Bus stand, Shastri chowk etc/

### *Survey of shopkeepers / traders:*

Shopkeepers and traders were surveyed to get an idea of quality of raw material, the substituted species, their name, different malpractices adopted by the traders in the local market etc. Traders exclusively selling raw medicinal plants in the local market were chosen randomly for present study. Out of total twelve (12) traders, four (04) were surveyed (33%) with the help of pre designed questionnaires.

### *Ocular (Organoleptic) analysis of raw (dry) forest and market samples:*

Fresh samples of rhizomes were collected after

**Table 2 : Morphological identification of Bach rhizomes - various grades present in the forest and market samples of Dhamtari**

Sr. No.	Sorting under different categories / grades	Details of grades, specifications
1.	Good quality (Grade I)	Good looking (blackish brown color), big size, even shape, non infected rhizomes
2.	Species infected by fungus, insect	Rhizomes affected by fungus, insect, hollow rhizomes
3.	Other species/ Adulterants found	Totally different species from genuine species
4.	Chaff matter	Husk, twigs, leaves, rope pieces, stem, grasses etc.
5.	Soil and Sand	Soil, sand adhered with rhizomes, small stone particles

maturation from natural forests of Dhamtari division. Rhizomes were washed thoroughly to remove sand, soil etc. and than dried under partial shade conditions. Processed rhizomes were packed in polybags and kept under room till further analysis. Market samples (raw) of rhizomes were collected from local traders of Dhamtari in the month of March 2008. The traders were asked to provide good quality and fresh samples of rhizomes. One kilogram raw material (dry) from each trader was procured and analyzed using different morphological parameters. After sorting of the raw (dry) material, various grades were made. The identification and documentation of adulterated species and other chaff material was done with the help taxonomist, botanists and consulting flora, secondary literature etc. Besides this, local Vaidyas, forest department officials and medicinal plant experts were also consulted.

## RESULTS AND DISCUSSION

### *Prevalent harvesting practice of Bach in Dhamtari natural forests:*

Generally, collection is done after the rains *i.e.* October-November months. Manual uprooting was found common practice as the species prefer to grow in the marshy soil or wet places and easy to uproot. On an average two person per family were involved in root harvesting from forest. For them harvesting from forest is a tedious job as the plant grows in special habitat conditions *i.e.* damp places, near water body, ponds etc. Rhizomes were dried under tree shade after removing leaves and lateral rhizomes. After cutting of rhizomes, shade drying was done. After 4-5 days of sun drying and cleaning, the material was packed in jute or cloth bags and kept in storage rooms. It was also observed that sometimes few gatherers harvest Kulanjan along with Bach (Fig. 2 and 3). Due to similarity in rhizomes and availability at the same harvesting season, this species is collected unintentionally by the gatherers (Fig. 4).

### *Prevalent malpractices adopted by the traders:*

In the study area, misidentification of species was observed among collectors as well as traders. Out of four, two traders were found selling Kulanjan rhizomes after mixing it with Bach. It was noted that Kulanjan rhizomes are very much similar to genuine species in morphological aspects and hence, gatheres as well as traders (after drying) fails to differentiate the rhizomes of both species.

Bach rhizomes had been collected from the natural forests at an early or immature stage (*i.e.* in the month of October-November). Rhizomes were collected destructively by uprooting whole plant in the natural forest



Fig. 2 : Bach (*Acorus calamus*) plant



Fig. 3 : Bach dried Rhizome



Fig. 4 : Kulanjan (*Alpinia galanga*) dried rhizomes

of Dhamtari district. Mostly young plants were uprooted with the help of small pick axes and sometimes manually from the forests. However, in the natural forests rhizomes matures in the month of December (Singh *et.al*,2001).

The data depicted in Table-3 shows ocular observation of samples collected from natural forest and market traders of study area. It is clear from the data that maximum proportion (96.5%) of best quality rhizomes was found in samples collected from natural forests (965 gm./kg.). On the contrary, less proportion (74.5%) was noted in the samples collected from market traders (Avg.745 gm. /kg.). The proportion of Adulterant species (14.5%) was recorded more in samples collected from local market (Avg.145 gm./kg.), whereas nil in the samples collected from forest. The proportion of chaff matter was recorded more (6.0%) in market samples in contrast with forest samples (2.5%).

#### ***Current harvesting practices:***

The primary collector usually collects immature and small sized rhizomes from the nearby forests before fruiting. Mostly they uproot whole plant from the ground without leaving seed for future regeneration. Uprooting whole plant manually is a common practice as the species prefer to grow in damp places. Misidentification of species was observed among collectors as well as traders. The immature extraction of fruits, rhizomes, tubers etc has drastically reduced the quality as well as quantity of the raw product to the below critical level. Oudhiya (2001) while working in the Chhattisgarh forests reported that due to increasing demand and unscientific exploitation, Bach is now found in isolated patches. Scientists working at Indian Institute of Forest Management, Bhopal (M.P) had conducted a number of studies on sustainable harvesting, value addition, processing of some important medicinal plants and reported that due to unripe collection, the yield per plant and quality of raw material were declining. The factors responsible are competition among collectors to collect as much as, unripe harvesting, high price of product in the market etc. Further, it was suggested that the collection before maturation should not be permitted so as to maintain raw material quality (Prasad *et al.*2002; Prasad *et al.*2003; Mishra, *et al.* 2003; Mishra and Kotwal 2007)

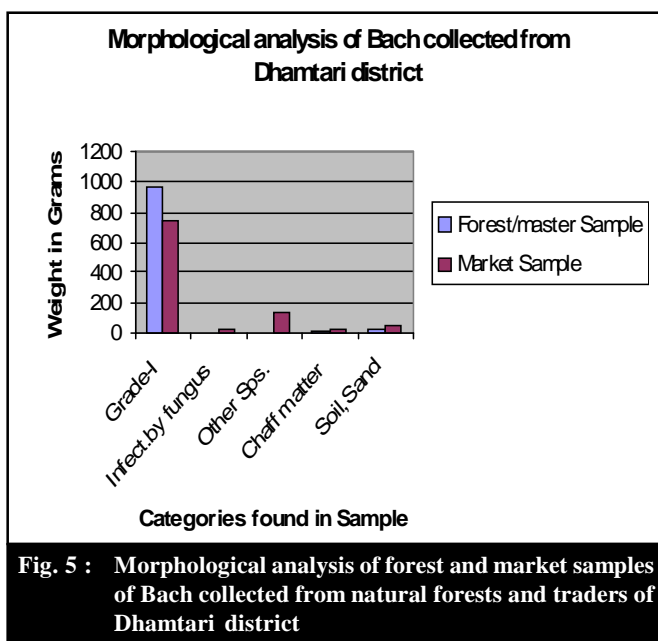
#### ***Market sample analysis:***

Results of market samples shows that traders also mixes Kulanjan (*A. galanga*) rhizomes as adulterants, whereas no such anomaly was observed in forest samples. Out of four, two traders were found selling Kulanjan rhizomes after mixing it with Bach. Presence of adulterant

**Table 3 : Sample analysis of one kilogram samples obtained from natural forest and local market of Dhamtari**

Sample	Good Quality/ Grade-I (gm./kg.)	Infected by fungus, insect (gm./kg.)	Other species/ adulterants found* (gm./kg)	Chaff matter (gm./kg.)	Soil, sand etc. (gm./kg.)
<b>Forest/master sample collected from natural forests of Dhamtari, processed under lab</b>					
Forest sample	965.00 ±0.35 (96.5%)	00	00	10.00 ±0.11 (1.0%)	25.00 ±0.20 (2.5%)
<b>Market samples collected from 04 local traders of Dhamtari city</b>					
Trader-1	685.00 ±0.92	55.00 ±0.45	230.00* ±1.03	15.00 ±0.09	15.00 ±0.16
Trader-2	900.00 ±0.78	15.00 ±0.12	00	20.00 ±0.18	65.00 ±0.44
Trader-3	560.00 ±1.02	10.00 ±0.21	350.00* ±0.67	10.00 ±0.11	70.00 ±0.23
Trader-4	830.00 ±0.47	25.00 ±0.43	00	55.00 ±0.27	90.00 ±0.84
Avg. of traders	743.75 (74.5%)	25.00 (2.5%)	145.00 (14.5%)	25.00 (2.5%)	60.00 (6.0%)

\*= Kulanjan (*A. galanga*) rhizomes.



**Fig. 5 :** Morphological analysis of forest and market samples of Bach collected from natural forests and traders of Dhamtari district

species and old rhizomes (approx.25%) of same species in the market samples indicates poor raw material quality. The quality of raw plant materials can be influenced by human error or unscrupulous operators. Accidental botanical substitution or even deliberate substitution can occur. Rhizomes of *A. galanga* and *Aconitum* spp. are sometimes erroneously supplied in place of Bach. The commercial material is also adulterated with the rhizomes of *Costus speciosus* and traded in the markets (FRLHT, 2007). Scientists (Vasudevan,1983; Puri and Jain,1988; Tewari, 1991; Rawat *et.al.*,1996; Saraswathy,2001) observed that in herbal markets of the country, not only the

various species of particular genus but entirely different taxa are being sold under the same vernacular name. Adulteration and substitutions are common in herbal raw material trade and drastically impacting the raw material quality (Uniyal and Joshi, 1993; Mitra and Kannan, 2007).

### Conclusion:

Results of the present study indicate that Bach rhizomes are adulterated both intentionally and unintentionally. Immature rhizome collection was observed in the study area. Due to occurrence in special habitat conditions, less availability, competition among villagers and other reasons, the occurrence and growth of this species is severely affected. The stakeholders resort to unsustainable practices and use adulterated raw material. Few of them were also involved in malpractices like selling Kulanjan rhizomes, as well as infected and old raw material of same species. The objective of these malpractices is to increase the volume of their produce and thereby getting more prices in the market. End users are generally unaware about the similar appearance of both rhizomes and fails to differentiate from genuine species. Major reasons for adulteration in the study area are mis-identification of species, premature root harvesting, mixing of old rhizomes etc.

The present paper suggests some procedures to prevent adulteration in raw (dry) medicinal plant in the market.

### Primary Collectors:

The harvesting of Bach should be done after

maturation (December onwards); Training should be given for proper identification of species, drying, processing etc.; Cultivation also greatly reduces the possibility of mis-identification and adulteration; Mass cultivation of this species is needed and systematic programs are required to be undertaken for creating awareness at field level.

#### **Traders:**

Handling of the plant material such as cleaning, drying and storage, should be carried out by trained personnel; Local suppliers are generally not aware about the technical knowledge of the plant / parts and not fully aware about the spurious supply; Awareness at field level should be given to all stakeholders dealing in raw (dry) medicinal plants; Suppliers and traders should be trained and educated about the World Health Organization (WHO) standards.

#### **Forest department:**

Sustainable harvesting practices should be inserted in the Good Collection Practices (GCP) as part of Working Plan in the forest department; State wise raw produce (dry) certification and testing laboratory should be established; The statutory provisions would ensure the quality standards and violation of which leads to punishment, these are imposed by authorities and are necessary to do business.

#### **Ayurvedic industry:**

Crude herbal material is particularly prone to several specific quality hazards so it is important to ensure that marketed herbal products are of suitable quality; Pharmacists are advised to contact the manufacturers directly if they are in any doubt about the pharmaceutical quality of a particular herbal material; ISO-9000 standard like certification by the Authorities (like G.Os, NGOs) for raw material can immediately promoted to encourage 'quality' awareness in industry and amongst consumers.

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