



**A Review on *Amorphophallus* species: Important Medicinal
Wild Food Crops of Odisha**

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Abstract

Wild tuber crops are a paramount wild food among tribal communities of Odisha. The aborigines collected different types of wild tubers and store them for off agriculture seasons, food scarcity and medicinal purposes. The major wild tuber crops are belongs to family Dioscoreaceae and Araceae in Odisha. Among them, genus *Amorphophallus* belongs to family Araceae, are important as per availability and consumption rate. The literature survey revealed that species of this genus are used against different types of microbial infections and other diseases due to possess different types of bioactive compounds. The present work highlights the nutritional and pharmacological activity of *Amorphophallus* species available in Odisha, with giving attention to conserve this wild food plants for sustainable development.

Key-Words: *Amorphophallus* species., Food values, Medicinal values, Pharmacological properties

Introduction

Odisha claims to have a noticeable position among the states and Union Territories of India, for having the largest types of tribal communities, that is 62 in number including 13 vulnerable tribal groups. It was the third highest tribal populations numbering over 8 millions, which is about 9.7 % of the country's total population constituting 22.13 % of the state's total population as per 2001 census. It means among every five persons one belongs to a scheduled tribe community in the state. Every tribal group represents unique indigenous food and ethnobotanical systems that include the mode of taking or applying externally or internally plant parts as a cure. The tribal communities of the state depend on wild resources [1] such as wild edible flowers, leaves, fruits, nuts, berries, stems, rhizome, roots and tubers for food and medicine. Among them, wild tuber crops are most important as they provide good source of fiberous food with rich carbohydrate and starch during critical time. These are *Dioscorea* species, *Amorphophallus* species, *Lassia* species, etc. Among all above species, *Amorphophallus* is widely consumed to meet their daily food requirement and more particularly during the period of food crisis. The value of wild edible plants in food security has not been given sufficient attention in India and particularly in Odisha.

During last few years some attempt has been made to document the rich indigenous knowledge on the medicinal uses of wild plants [2] but socio- economic, traditional and nutritional aspect of wild food plants still lack adequate attention. There are at least 3000 edible plants species which are unknown to man and out of which 30 crops contribute to more than 90 % of world's calorie intake and only 120 crops are economically important in a national scale [3]. There are about 1532 edible wild food species available in India mostly in Eastern Ghats, Western Ghats and Himalayan hill ranges [2]. In Eastern Ghats particularly in Simlipal Biosphere Reserve Forest, several tribal communities depend on wild food plants using their daily food requirement and also during the periods of food shortage and famine [4]. Tubers play a major role in supplementing staple foods with micronutrients and can constitute a "Safety Net" during the periods of food shortage[5]. They represent cheap but quality nutrition for large segments of the population in both tribal and rural areas. Knowledge on wild tubers is gradually decline and even disappearing with increased modernization. Documentation and revalorizing indigenous knowledge on wild tubers is urgently needed to promote nutritional health of the local inhabitants and beyond to conserve genetic and cultural diversity as well. Almost all tribal groups of Odisha have been using *Amorphophallus* species (Oluā) as food that are generally taken as vegetables. The corms constitute an economically important staple food for millions of people. They are also consumed wildly in

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India and Sri Lanka, although elsewhere they are seen as a famine crop, to be used when more popular because of its amazing health benefits [4]. The root of the plant is efficient in treating ophthalmia and are great for treating piles and hemorrhages [6]. Consumption of this crop increases the immunity level of our body [7]. This vegetable is high in nutrients and is also known for having valuable vitamins, antioxidants and mineral content [3]. Therefore an attempt has been taken to gather the food values, ethnic values, and pharmacological properties of the *Amorphophallus* species available in Odisha.

Botanical description

Amorphophallus are herbs with bulb- like tubers known as “corm”. Leaves are segmented pinnati- or bipinnatisect. Peduncles usually long, spathes broadly ovate or oblong; limb campanulate or funnel shaped convoluted or open. Spadix included or exserted. Flowers are monoecious. Perianth 0, stamens 1-6, anthers sessile. Ovaries usually globose or ovoid, styles generally short or long. Berries are subglobose or ovoid. Seeds are exalbuminous [8].

Distribution

The *Amorphophallus* species are mostly found in the Eastern boundary of Polynesia, Western Africa, Japan-Phillipines- Taiwan- New Guinea, Central Thailand, Southward via Sumatra, Indonesia, Malaysia and several other parts of South Asian Countries- Ceylon and Malaya [10]. They also belong to tropical and subtropical zones of the paleotropics, and rich from West Africa to the Pacific islands [9]. They are distributed throughout India. They are rich in Bengal, Sikkim, Khasia Hills, Kerala, Maharashtra, Tamil Nadu, Uttar Pradesh, Punjab, Bihar, Assam and Odisha. In Odisha *Amorphophallus* species are rich at Papadahandi, Jeypore, Koraput, Gandhamardhan, Khurda, Cuttack, Similipal Biosphere Reserve etc. [8].

Nutritional values

Amorphophallus paeoniifolius is quite popular as a vegetable in several cuisines throughout the world. The rhizome, leaves and petioles of the plant is edible [13]. Santosa *et al.*, (2002) reported the morphological and nutritional characterization of Elephant foot yam (*Amorphophallus paeoniifolius*) [5]. Surendra and Parimalavalli (2012) highlighted the essential chemical and functional properties of starch isolated from *Amorphophallus* species [14].

Ethnic values

Amorphophallus are long been used in China, Japan and South East Asia as food source and traditional medicine [11]. In Traditional Chinese Medicine, a gel is prepared from the flower of *Amorphophallus*

paeoniifolius which has been used for detoxification, tumour- suppression, blood stasis alleviation and phlegm liquefaction. This gel is also used for treatment of asthma, cough, hernia, burns, hematological and skin disorders [11]. *Amorphophallus campanulatus* tuber is used for the treatment of enlarged spleen [6] and rheumatism [12]. The tubers are known to treat stomach ailments [6], fever, diarrhea, piles and given as restorative in dyspepsia enlargement [11]. These are also used in case of anaemia, constipation, ear aches, elephantiasis, fatigue, inflammations [6], intercostal neuralgia, pimples, seminal weakness, swelling of throat and general disability [10]. Petioles used in scorpion bites and dysmenorrhea [12].

Pharmacological values

Anti- Inflammatory Activity

The corm of *Amorphophallus* species have diverse property of free radical scavenging, the methanolic and aqueous extract of *Amorphophallus campanulatus* tuber have shown good antioxidant activity [12]. The hydroalcohol extract of *Amorphophallus bulbifer* (whole plant) exhibited anti- inflammatory activity of 56.5(p<0.001) and 57.1% (p<0.001) inhibition compared to the control group in the carrageenan and histamine- induced inflammation model at a dose of 200 mg/kg in Wistar rats and mice [6].

Analgesic Activity

Analgesic activity in the whole plant of *Amorphophallus bulbifer* have shown effective analgesic activity using tail flick and tail immersion techniques by measuring the reaction time of the animals (rats). The extract showed reaction times of 7.33 (p<0.001) and 7.83 (p<0.001) min at a dose of 200 mg/kg while the normal and reference groups exhibited reaction times of 2.16, 2.66 and 8.16 (p<0.001) and 8.5 (p<0.001) which supports the fact of its use in traditional medical practice [6].

Anti- cancer Activity

The dietary factors of *Amorphophallus* species play an important role in human health, mainly in the treatment of certain chronic diseases including cancer [15] and contain anti- tumour compounds which are candidates for chemo preventive agents against cancer development [16]. The anticancer property of nutrients derived constituents have been proved indifferent *in vitro* and *in vivo* models leading an increased emphasis on cancer prevention strategies [17]. The root is oxytoxic and sialagogue, hence used in treatment of cancer [18]. *Amorphophallus campanulatus* has anticancer properties [19]. The ethanolic extract of *Amorphophallus paeoniifolius* tubers showed antioxidant and anti- tumour activity against 7, 12-

dimethyl benz (a) anthracene (DMBA) induced mammary tumour in rats. The results showed total flavonoids compound was found to be 8.8g/100g calculated as Quercetin equivalent and the effect of the extract on tumour latency and tumour burden were found extremely significant at $p < 0.001$ [20].

Hepatoprotective Property

The increase in the levels of superoxide dismutase (SOD), catalase (CAT) and glutathion peroxidase (GPx) in dried tubers of *Amorphophallus campanulatus* shows the plant may possess hepatoprotective property [21]. The hepatoprotective activity of methanol and aqueous extracts of *Amorphophallus paeoniifolius* tubers was confirmed against paracetamol induced liver damage in rats. It caused a significant reduction in the values of sGOT, sGPT, sALP and sB ($p < 0.01$) almost comparable to the silymarin and liv-52 (standard hepatoprotective agents) [22].

Anti- bacterial Activity

The flavonoid, 3, 5- diacetyltambulin isolated from *Amorphophallus campanulatus* showed significant antibacterial activities against four gram positive bacteria (*Bacillus subtilis*, *Bacillus megaterium*, *Staphylococcus aureus*, *Streptococcus β -haemolyticus*) and six gram negative bacteria (*Escherichia coli*, *Shigella dysenteria*, *Shigella sonnei*, *Shigella flexneri*, *Pseudomonas aeruginosa*, *Salmonella typhi*). The MIC values against these bacteria ranged from 8 to 64 μ g/ml [23]. The aqueous and methanolic extract of *Amorphophallus campanulatus* (suran) showed moderate to high activity against bacterial strains (*Bacillus cereus*, *Bacillus subtilis*, *Enterobacter aerogenes*, *Enterobacter agglomerans*, *Salmonella enteritidis*, *Salmonella choleraesuis*, *Enterobacter faecalis*, *Bacillus sphericus*, *Bacillus thruengiensis* and *Cryptococcus meningitis*) [24].

Anti- fungal Activity

The *Amorphophallus* species showed significant activity against *Candida albicans*. Thus can be used in the folk medicine [25]. The complete genome sequence of *Bacillus subtilis* strain BSn5, isolated from *Amorphophallus* species, calli tissue showed strong inhibitory activity to *Erwinia carotova* subspecies *carotova*, which causes *Amorphophallus* soft rot disease and affects the industry development of this organism [26]. *Amorphophallus campanulatus* showed good antifungal activity against *Aspergillus niger*, *Aspergillus flavus* and *Rhizopus arryzae* [27].

Anti- diabetic Activity

Li *et al.*, (2004) reported that *Amorphophallus* species have close attention to traditional Chinese medical therapeutics and natural medicines for treatment of Diabetes mellitus and its complications [28]. The acetone extract of elephant foot yam (*Amorphophallus paeoniifolius* Dennst. Nicolson) at 0.1 and 0.25% in the diet of streptozotocin-induced male Wistar diabetic rats were examined for water intake, diet intake, urine output, gain in body weight, urine sugar, fasting blood sugar (FBS) and glomerular filtration rate (GFR). The acetone fed diabetic (AFD) group showed a 45% reduction relative to the starch fed diabetic (SFD) group which clearly indicate that the acetone extract of elephant foot yam is effective for streptozotocin-induced diabetic rats [29].

Immunomodulatory Activity

The effect of methanol extract (ME) of *Amorphophallus campanulatus* tuber on immunological function in mice when administered orally at doses of 250 and 500 mg/kg, exhibited immunomodulatory activity by causing a significant decrease in charcoal clearance, spleen index and delayed- type hypersensitivity (DTH) response [7].

Anthelmintic Activity

The chloroform, methanol extracts and crude tannins of *Amorphophallus* species showed good anti- helmintic activity. Paralysis and death times of crude tannins were very close to the standard drug Albendazole [30].

Cell toxicity

The cytotoxicity property of different solvent extracts of *Amorphophallus paeoniifolius* tuber were tested using *Allium cepa* L. root tip cells and HEP- 2 cell line as two model *in vitro* systems. The magnitude of cytotoxicity was found to be high in petroleum ether and ethanol fractions which displayed a dose dependent antiproliferative activity on HEP- 2 cells and confirms the cytotoxic property [31].

Conclusion

Before the introduction of modern medicines, disease treatment was entirely managed by herbal remedies. It is estimated that about 80% of the world population residing in the vast rural areas of the developing and under developed countries still rely mainly on medicinal plants. It is quite obvious that, the *Amorphophallus* species are widely used in traditional medicinal systems of India and has been reported to possess hepatoprotective, anti- inflammatory, antifungal, antibacterial properties and also used in healing of wounds. The *Amorphophallus* species are rich in carbohydrates, alkaloids, phenols, tannins, steroids, flavones, coumarines and thus can be

concluded that the plant contain important constituents for pharmacological activity. The present review summarizes some pharmacological studies on *Amorphophallus* species. The phytochemical constituents and isolated bioactive compounds of *Amorphophallus* species can be investigated further to achieve lead molecules in the search of novel herbal drugs. The paper also gives attention regarding conservation of such wild resources available in the state for sustainable development.

Acknowledgement

Authors are thankful to the H.O.D., Department of Botany, Ravenshaw University, Cuttack.

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How to cite this article

Behera A., Kumar S. and Jena P.K. (2014). A Review on *Amorphophallus species*: Important Medicinal Wild Food Crops of Odisha. *Int. J. Pharm. Life Sci.*, 5(5):3512-3516.

Source of Support: Nil; Conflict of Interest: None declared

Received: 09.04.14; Revised: 12.04.14; Accepted:06.04.14