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Dedicated to

All nature lovers, botanists, academicians, or anyone who seeks to learn the bioresources of India with medicinal values

BACKGROUND

Medico-Biowealth of India is a series of edited books published by APRF Publishers under the Ambika Prasad Research Foundation, India. The aim of the publication is to document the traditional knowledge of India for the preservation of Indigenous Traditional Knowledge (ITK) and create awareness about it. Medicinal plants play an important role in primary health care systems. They also provide nutraceuticals, which are highly demanded in contemporary situations throughout the world. Therefore, documentation of such bio-wealth is an important task for us, and we are doing the same for sustainable development and utilization. The series also brings together the different researchers in the country. In this book, seven chapters are published by 27 researchers from different states of India. The authors have documented the implications of *Phlogacanthus thyrsiformis* for ethnobotanical use by the Karbi tribe of Karbi Block in Biswanath Chariali, Sonitpur district, Assam, India; Less known ethnomedicinal plants of India; climbing plants with special reference to their ecological and medicinal importance; Plants used against fungal infections: sources of future drugs; *Houttuynia cordata* Thunb.: A potential nutraceutical herb; *Alocasia indica* (Lour.) Spach: A potential nutraceutical wetland flora; Pollination in the Cucurbitaceae family and medicinal uses of selected cucurbits. The documentation will be helpful in designing the experimental works and value addition.

Houttuynia cordata Thunb.: A potential nutraceutical herb

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Abstract: *Houttuynia cordata* is an aromatic herb widely used in Northeastern states of India for various purposes, like spice and condiments, cooked as vegetables, or therapeutic purposes by the indigenous traditional healers for various ailments. Many of the tribal or indigenous people of these states are also aware of many of its therapeutic uses. Although they are old practices, many researchers and scientists have recently taken an interest in their varied medicinal values and therapeutic potential. Various phytochemical compounds have been detected and isolated that are responsible for their therapeutic purpose. Here, an attempt has been carried out to gather the ethnobotanical uses from different states of Northeast India reported and compare them with the present ethnobotanical study from Manipur. Morphological characters with photographs of the species are presented here for easy identification. Food prepared using H. *cordata* by the Meitei community of Manipur is shown here. The comparative account of food and medicine revealed that this species is a potential nutraceutical herb. Incorporating this species into a normal diet can be highly beneficial for people's health. Cultivation and value addition of such potential nutraceutical herbs could help people find more options for healthy, nutritious food at reasonable prices.

Keywords: Toningkok, spices, food, therapeutic values, Manipur

Introduction: *Houttuynia cordata,* locally known as Toningkok in Manipur State, Northeast India, is an aromatic herb used in all the states of Northeast India. It is native to many Asian countries like China, Korea, Japan, Thailand, Vietnam, India, Bangladesh, Bhutan, Nepal, etc. and has been introduced in many countries like Australia, New Zealand, North America, and the Pacific Islands (Fu et al., 2013; POWO). In India, it is entirely distributed in northeastern states, i.e., Manipur, Nagaland, Assam, Meghalaya, Mizoram, Tripura, Arunachal Pradesh, and Sikkim (Pradheep et al., 2016; Kumar et al.,

2014; Rathi et al., 2013). Traditional use of *H. cordata* as food and for therapeutic purposes is an old system, but many scientists and researchers have increasingly started working on the pharmacological aspect of the species over the past decade. In many Asian countries like China, Vietnam, Japan, Korea, Thailand, etc., the species is a well-known plant that is already part of their diet. In India, the different tribal and indigenous communities are aware of the plant and its edibility. Different communities have different ways of consuming food and for therapeutic purposes, although not many of the ways have been documented so far. Researchers and scientists in the last decade have worked on the phytochemical compounds responsible for therapeutic values; many have been isolated and identified over time. Reports have revealed the presence of alkaloids, flavonoids, polyphenols, and volatile oils (Fu et al., 2013). Many research activities have shown that the anti-inflammatory activity and antioxidant activity of *H. cordata* have contributed to various therapeutic properties. Some of the therapeutic values include protection of the lungs, intestinal flora, and other ailments like heart diseases, liver problems, kidney problems, diabetes, rheumatic arthritis, and antiviral and antibacterial diseases. Reports have shown that it works very well to treat the Corona virus (SAR-CoV-2). In Mizoram, India, many people were given treatment with *H. cordata* against SAR-CoV-2 during the COVID-19 pandemic (Laldinsangi, 2022). About 19 types of alkaloids have been identified, apart from the many flavonoids identified. Wild edible foods with nutritional and therapeutic value are of high concern in the present world. The availability of nutritional food has been affected by different factors, like high inflation on food prices, advanced agricultural practices for using fertilizers, pesticides, and fungicides, high productivity, adulteration of food, etc. The very fast urbanization has left very few to no spaces for home gardens and shrinking forest areas globally. The recent report of FAO 2023 revealed that worldwide hunger is prevalent at about 9.2 %. Again, the global population of 11.3 % has been severely affected by the food insecurity issue in the world, and 42 % of the global population is not able to get a healthy diet (FAO, IFAD, UNICEF, WFP, WHO, 2023; Devi et al., 2022). The issue of food insecurity is a matter of concern, and an attempt has been made here to document the ethnobotanical use of *Houttuynia cordata* by the Meitei community of Manipur and show a comparative account of its uses with the different states of Northeast India (Table 1). The correlation of its food and therapeutic uses with respect to the large phytochemical compounds reported shows that

the species is a highly potential nutraceutical plant, and cultivation and value addition of the species could add the species to the diets of people at reasonable prices.

Methodology: *H. cordata* (Figure 1) is an important aromatic herb distributed and used for various purposes in all the states of Northeast India. The Meitei community of Manipur consumed the species, especially as condiments for the spicy salad, also called Singju. The traditional way of consuming the species is illustrated in Figure 2. The comparative account of the ethnobotanical uses of the species from different states reported is given hereunder. The morphological characters are described with photographs of the species in this document for easy identification. The various food and therapeutic potentials of the species make it a highly potent nutraceutical herb.

Results and discussion

Morphological description: It is a perennial aromatic creeping herb. Rhizomes creeping, thin, long, branching, pale yellow to white in colour, thin fibrous roots on internodes, glabrous at the nodes, aromatic; leaves simple, alternate, heart-shaped, cordate at the base and acuminate at the apex, abaxial surface green or sometimes line with purple lines along the margin and nerves, sheath at the lower part of petiole around the stem, glabrous, glandular, aromatic; inflorescence spikes, flower small, bracts four, white, appear like petals; fruits subglobose.

Ethnobotany of H. cordata: In Manipur, the aromatic herb *H. cordata* is mostly consumed by the Meitei community as a condiment to add flavour to spicy salads locally known as Singju or to a traditional delicacy known as Eromba. The preparation of Singju is illustrated with the mixture of spices and other less-known plants in the present study. However, it is also consumed as a cooked vegetable. The traditional local healers of Manipur, locally known as Maiba, used the species for therapeutic purposes in dysentery, stomach ulcers, muscular sprains, anaemia, gastritis, tuberculosis, stomach worms, etc. In Assam, people consume chutney and pickles, which are also used in the treatment of dysentery. In Sikkim and Nagaland, people used to treat helminths in the stomach. In Arunachal Pradesh, people use it for therapeutic purposes to add freshness to the body and treat sleep disorders and cardiovascular disorders (Rathi et al., 2013). In Meghalaya, the Khasi and Jaintia tribes consume salad and use it for ailments like reducing blood sugar (Kumar et al., 2014). In Nagaland, the Konyak tribe consumed cooked vegetables or added pickles as flavouring agents. They are also used to enhance appetite (Pradheep et al., 2016). The comparative ethnobotanical uses of *H. cordata* Reports of edibility from

other parts of the world revealed that in China and Vietnam, the rhizome and leaves are consumed as vegetables. In Japan, the whole plant is used in preparing beverages and deodorant. In Korea, the whole plant is used in carbonated drinks, pickles, and soy sauce. Again, in Thailand, the young leaves are cooked and consumed as vegetables.

Conclusion: The food and therapeutic values in Northeast India and the wide common use of *H. cordata* globally, especially in Asian countries, show that the species has high potential to be used as a nutraceutical plant. The very high increase in research activities regarding its pharmacological values also proved that the species is an exceptionally potential source of future drug development. Such plants, if incorporated into normal diets, could be highly beneficial and provide immunity and protection from many diseases. Cultivation and value addition of the species are recommended to provide a nutraceutical value at reasonable prices.

Table 1: Comparative account of ethnobotanical values of *H. cordata* from Northeastern states of India

State	***H. cordata* parts used**	**Ethnobotanical uses**	**Source**
Manipur	Rhizomes and Leaves	Use as condiments	Present study
Manipur	Whole Plant	Cooked as vegetables	Present study
Manipur	Rhizomes	To treat dysentery, muscular sprain, stomach ulcer, anaemia, gastritis, tuberculosis, intestinal worms, etc.	Rathi et al. (2013)
Assam	Whole plant	Chutney & Pickles	Rathi et al. (2013)
Assam	Whole plant	Dysentery	Rathi et al. (2013)
Sikkim	Whole plant	Stomach worms	Rathi et al. (2013)
Nagaland	Whole plant	Cooked as vegetables & Pickles	Rathi et al. (2013)
Nagaland	Rhizome	Improve apetite	Pradheep et al. (2016)
Meghalaya	Whole plant	Salads	Kumar et al. (2014)
Meghalaya	Whole plant	Reduces blood sugar	Kumar et al. (2014)
Mizoram	Whole plant	Locally treated Sars-CoV_2 virus	Laldinsangi (2022)
Arunachal Pradesh	Whole plant	Improves sleep, freshness and to treat cardiovascular disorders	Rathi et al. (2013)

Figure 1: *Houttuynia cordata* Thunb. in its habitat and depicting its leaves, flowers and roots

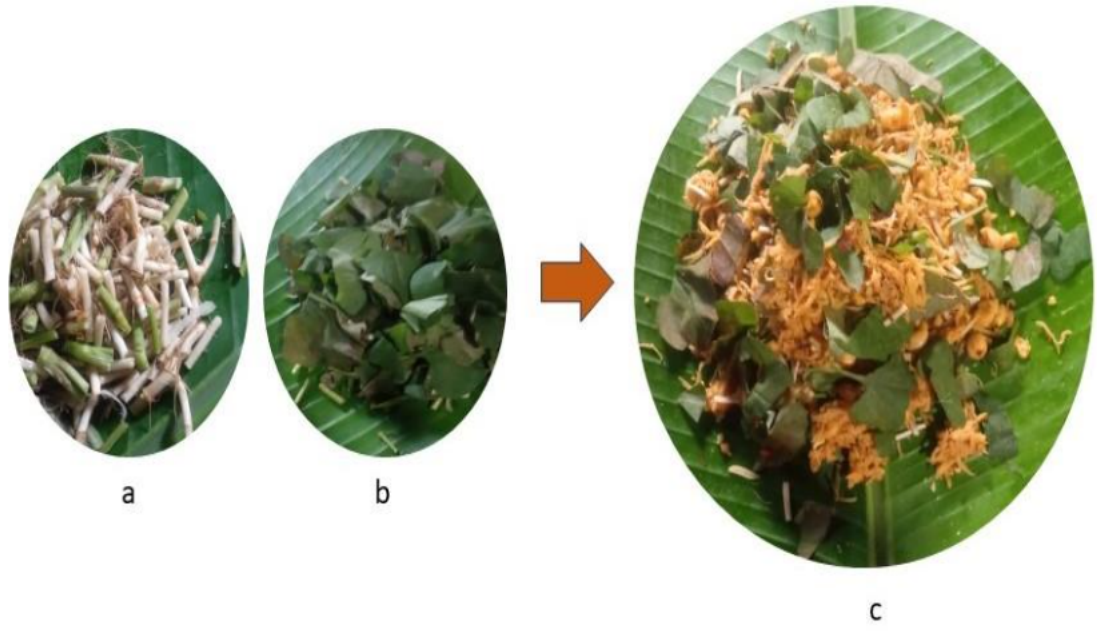

Figure 2: *H. cordata* used as condiments in a spicy salad locally known as Singju, a.) Rhizomes and b.) leaves of *H. cordata* c.) Sinju

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