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Research Article

TRADITIONAL USES OF THREATENED *ANGIOPTERIS EVECTA* (G.FORST.) HOFFM. (MARATTIACEAE) AS AN ANTIDOTE TO SNAKE BITES AND INSECT STINGS BY THE *TANGSA* TRIBE OF ARUNACHAL PRADESH, INDIA

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ABSTRACT: *Angiopteris evecta* (G.Forst) Hoffm. (Marattiaceae), an endangered fern, utilized medicinally by several traditional societies across the world. Its use as food is rarely reported in literature. The rhizome of *Angiopteris evecta* is used by members of the *Tangsa* tribe, who live mostly in the Patkai Hills of the Changlang district of Arunachal Pradesh (India), both as a famine food and a remedy for snake bites and insect stings. The article documented the preparation of rhizomes for consumption and as an antidote to snake bites and insect stings.

Key words: *Angiopteris evecta*, *Tangsa*, Famine-food, Snakebite, Insect bite, Spider sting, Antidote.

INTRODUCTION

For a long time, man has relied on plants for the majority of his basic resources. Plants are used in healthcare since some ancient stages of human civilization and the ethnic communities residing in remote areas are still practicing such use of plants (Ayam and Nyitan 2017, Pattanayak 2021, Pradhan *et al.* 2021). Documentation of such uses and performing scientific studies on them is an important aspect in the field of development of new medicines (Ayam 2018, Patel *et al.* 2022, Paul *et al.* 2022). The people of Arunachal also obtain several essential items from the natural environment such as fruits and vegetables for consumption and for using it as medicine (Ayam 2017, Ayam and Hage 2017). Activities of the medicinal plants inside the body may follow different steps than laboratory-derived medicines (Pattanayak 2020). The Tangsa tribe of Changlang is not an exception and they also derive several essential items from the surrounding environment for their survival (Lungphi *et al.* 2022). 'Tangsa' is an ethnic Sino-Burmese community living in the Changlang district of Arunachal Pradesh and the Tinsukia district of Assam in India, as well as in some areas of Myanmar. In India, they have mainly lived in the Patkai-Hills region since the early 13th century after migrating out of Myanmar (Barua 1991, Barkataki-Ruscheweyh 2013, Morey 2022). Plants that are inexpensive or readily available but used to nourish people in times of hunger and starvation, whether caused by extreme poverty due to economic depression, war, or natural disasters, are often referred to as famine foods. The Tangsa people lead a forest-dependent life, and whenever sufficient foods are not available in vegetation and famine-like situations occurs they consume plants that are not regularly used as food but are edible without any harm. Apart from angiosperms, gymnosperms, mushrooms, and many pteridophytes are often used as food and medicine in several parts of northeast India (Srivastav *et al.* 2009, Gogoi and Das 2002, Lungphi *et al.* 2021). The rhizome of the primitive fern *Angiopteris evecta* (G.Forst.) Hoffm. (Marattiaceae), commonly known as Elephant fern, King fern, Mule's foot fern, oriental vessel fern, Giant Fern, and locally as Sahmah/ Chahmah/ Sehmeh in the Tangsa dialect of Changlang district, Arunachal Pradesh is used as one of the medicinally important plants and is also consumed as food during famine or food scarcity.

The species is native to Southeast Asia and Oceania, from Sri Lanka, India, and Bangladesh in the west through to Melanesia, Micronesia, and Polynesia in the east, and from Japan in the north to northern and

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eastern Australia in the south (Rojas-Sandoval 2018). However, the species has been introduced in many other places mostly as an ornamental fern (USDA-ARS 2018). Angiopteris evecta is being medicinally used in many areas. In Malaysia, the leaves are used for cough; in India, the roots are used for scabies and are also known for their antiplasmodial (Arnida *et al.* 2014), antibacterial and angiopteroside compound (Nilanthi *et al.* 2015, Anggia *et al.* 2015), antifungal (Khan and Omoloso 2008) and antituberculosis properties (Karthik *et al.* 2011, Anggia *et al.* 2015). Other uses recorded for the species include promoting hair growth (Mustarichie *et al.* 2016), treating piles (Das *et al.* 2008), stomach ache and intestinal ulcer (Karthik *et al.* 2011), diabetes (Sari *et al.* 2022), etc. *A. evecta* contain Angioptereroside (4-O-beta-D-Glucopyranosyl-L-thero-2-hexen-5-olide) which is important for its pharmaceutical properties (Hiroshi *et al.* 2018). Angiopteroside monohydrate compound was found to inhibit HIV-1 by Taveepanich *et al.* (2005). However, the way *Tangsa* people of Changlang district of Arunachal Pradesh use its rhizome/corm as an antidote to snake bites and insect stings is yet to be reported as important ethnobotanical information of *Angiopteris evecta*.

MATERIALS AND METHODS

Study area

The survey was conducted in the Tangsa-dominated (10,074 individuals, Anonymous 2014a, b), Changlang district with geographical coordinates of 26°40´ N-27° 40´ N Latitude and 95°11´ E- 97° 11´ E Longitudes; altitude 200 - 4571 m AMSL in the south-eastern corner of Arunachal Pradesh. It is surrounded by the Tinsukia district of Assam and the Lohit district of Arunachal Pradesh in the north; the Tirap district in the west and Myanmar in the southeast. The area receives an annual rainfall of (3800-4866) mm and 90.97 % of the area is forest-covered (FSI 2011, Anon 2013), with maximum and minimum temperatures between (32-38)°C in May and (10-15)°C in January (Chauhan *et al.* 1996).

Field Survey and data collection

The present survey on the uses of *Angiopteris evecta* by the people of the *Tangsa* community has been conducted in the Tangsa-inhabited villages in the Changlang district of Arunachal Pradesh. A total of 184 Tangsa-informants, both men and women, 25 - 70 years old, were interviewed using a semi-structured questionnaire that was prepared following Jain (1987) and Martin (2008). Participatory Rural Appraisal Approach was followed with the active involvement of local informants in interviews, meetings, and open discussions using the questionnaire (Song and Kim 2011, Song *et al.* 2013) to collect ethnomedicinal knowledge and practice by the *Tangsa* about the use of this famine-food plant. The questionnaire comprised several inquiries, including the local name, plant parts consumed, method of collection, method of preparation, the difficulties in preparation, the taste of food, the side effects from consumption, and medicinal uses. Before the record of traditional knowledge data, mandatory Free and Prior Informed Consent (FPIC) was obtained from the informants. Most of the people interviewed were farmers, hunters, and elderly people. Voucher specimens of plant parts were preserved following conventional methods (Bridson and Forman 1998, Das 2021) and will be deposited in the RGUH-Herbarium of the Department of Botany, Rajiv Gandhi University, Arunachal Pradesh. The present status of the nomenclature of the plant was verified from https://powo.science.kew.org/.

Method of collection

A. evecta is a perennial plant. So, whenever, people face scarcity of food they go for the collection of its rhizome. Generally, rhizomes are half-embedded in soil. People dig it out, remove the leaves and armor of old leaf bases and then wash in running water.

RESULTS AND DISCUSSION

The Rhizome of *Angiopteris evecta* (G.Forst.) Hoffm. is used by the *Tangsa* tribe as an anti-venom plant when affected by snake bites or spider stings. It is also used as a famine food during food scarcity. The rhizomes are huge, 20-60 cm in diameter, 15-30 cm high, and weighing 2-5 kg, blackish outside with white blaze (Fig. IB).

Traditional uses as medicine

Locally in Changlang, *Tangsa* people use this plant medicinally as an anti-venom or anti-dote against snake bites and spider stings. The rhizome is chopped and pounded into a paste which is then applied directly on the affected area as soon as possible and tied with the leaves of *Curculigo capitulata* if one is in the jungle and there is no cloth to tie. After reaching home they generally re-tie it with clothes and keep it till gets cured (Fig. 1A-1F).

Traditional uses as famine food

The starchy rhizome of the *Angiopteris evecta* is used as food during the scarcity of naturally available food by the *Tangsa* tribes of Arunachal Pradesh. The famine foods require substantial processing to reduce their toxic constituents and to make them edible (Minnis 1991). Similarly, the rhizomes collected from the wild are thoroughly washed in a stream by the *Tangsa* people and sliced into small pieces (0.3 - 0.5) cm thickness, and boiled with wood ash for (2 - 3) hours. After thorough cooking, it is again kept in flowing water overnight and washed away the dirt and toxic substance present in it, and served as food. This is the first traditional processing report of the plant for using it as food and also the first time report of using it as famine food from the *Tangsa* community. There are very few reports on the edible property of the *A. evecta*. The rhizome of the *A. evecta* was reported consumed by the Memba tribe of Dehang-Debang Biosphere Reserve; Arunachal Pradesh (Rethy *et al.* 2010); as a starchy food after processing, in flavoring rice and in the preparation of an alcoholic drink by the Australian Botanic Garden at Mount Annan (www.australianbotanicgarden.com.au/plants/flowering-calendar/angiopteris-evecta); as an ingredient of certain vegetable salad after partially boiling by certain communities in Manipur (Yumkham *et al.* 2016).

This wild fern is used medicinally in so many ways including antispasmodic (Arnida *et al.* 2014), antibiotic (Nilanthi *et al.* 2015, Anggia *et al.* 2015), antifungal (Khan and Omoloso 2008), antihelmintic (Vasudeva 1999) and anti-diabetic agents (Sari *et al.* 2022) and against scabies and Cancer (Sara and Deepa-Ruby 2022). However, the people of the *Tangsa* tribe in the Changlang district of Arunachal Pradesh use it as an antidote for insect stings and spider bites which is an addition to the traditional medicinal uses for the plant. Out of a total of 184 respondents who have reported as edible, only 76 persons reported its use as anti-venom. The response suggested that the popularity of the plant is more as an alternative food than as an antidote medicine. It may be due to the low income of the local households who frequently use the king fern as an alternative food and aware more as a food. However, since the incidence of snake and spider bites are rare occurrences the awareness of the plant as an anti-venom might have diminished in the general public. Therefore, the present study will help to preserve the traditional knowledge of the Tangsa tribe. Among the respondents cited as antivenom, the acceptability and satisfactory level of the rhizome of *Angiopteris evecta* against poisonous snake and spider bites is very high. Though the informants are satisfied with the recovery from the snake and spider stings by using *A. evecta* treatment, further phytochemical and scientific validation of the plant would help for possible drug discovery. The *Angiopteris evecta* is an Endangered (ER) species and deserves attention for its proper conservation according to IUCN RED plant guidelines (Srivastava 2008).

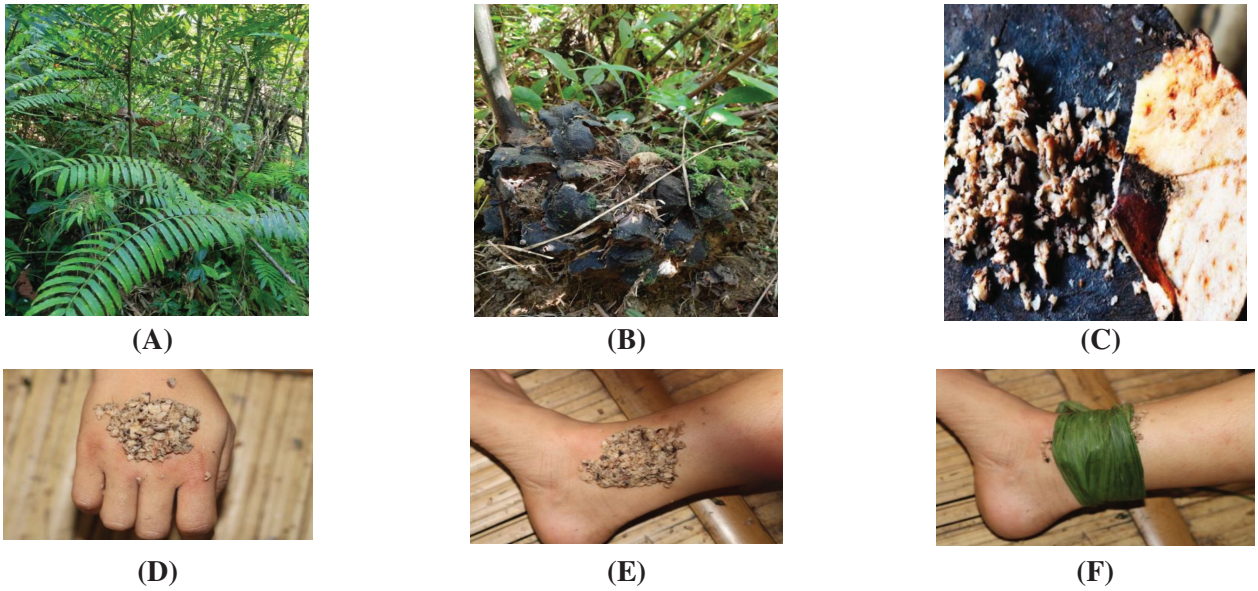

Fig. I. Medicinal uses of *Angiopteris evacta* (G.Forst.) Hoffm. against snake and spider stings. (A: *Angiopteris evacta* plant; B: Rhizome (parts used); C: chopped rhizome; D and E: chopped rhizome applied on sting area; F: tied with leaves of *Curculigo capitulata* on sting area).

CONCLUSION

The plant *Angiopteris evecta* is a slow-growing, wild, rare plant, and probably not cultivated (except in gardens as an ornamental plant). Though the traditional technology is good enough as a famine food for the regular consumption of its rhizome, the detoxification method needs to be standardized as it takes a lot of time during processing. As a newly recorded antidote to snake bites and insect stings, proper phytochemical analysis and bioactivity validation could yield fruitful results in drug discovery.

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