



## SHORT COMMUNICATION

# Medicinal plants used by the Apatani and Tagin tribes of Arunachal Pradesh for the treatment of stomach disorders

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## Abstract

Present study enumerated 16 species of medicinal plants effective against stomach related disorders popularly used by the traditional herbal healers of the Apatani and Tagin tribes of the Subansiri district of Arunachal Pradesh. We interviewed 35 key informants (15 from Apatani and 20 from Tagin tribes) from 6 villages who were specialized in treatment of digestive diseases. Of the total 16 species recorded, *Houttuynia cordata*, *Paederia foetida* and *Thladiantha ziroensis* have been reported as most potential species effective against severe dysentery, diarrhea and gastritis while rest 13 species were found used in traditional home remedies for constipation, indigestion, liver diseases and loss of appetite. The *Allium hookeri*, *Diplazium esculentum*, *Houttuynia cordata* and *Acmella oleracea* were frequently harvested and sold in the local market and have been found commercially viable species potential to ensure rural livelihood security. However, *Thladiantha ziroensis* was found rare in their natural habitat which need conservation attention.

**Keywords:** Medicinal Plants; Traditional Healers; Stomach Disorders; Apatani and Tagin; Subansiri; Arunachal Pradesh

## 1. Introduction

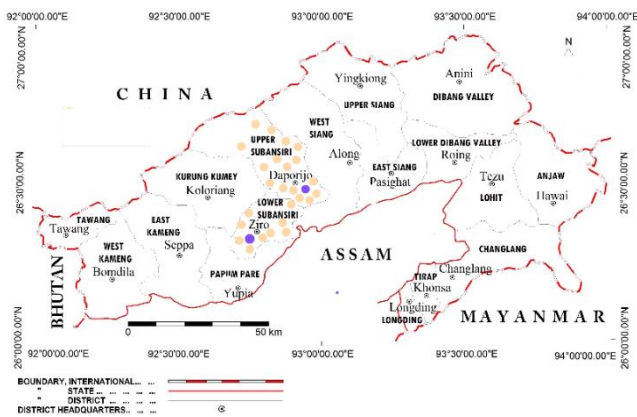
The state of Arunachal Pradesh is one among the top 12 Global Biodiversity Hotspot (Myers et al., 2000). It is endowed with rich diversity of flora and faunal species of medicinal, economics and cultural significance to the 25 major tribal communities and more than 110 sub-tribal groups living in close association with nature since time immemorial (Tag and Das, 2007). The Apatani and Tagin tribes of Arunachal Pradesh are mainly belonging to the Abotani tribal groups and they are found inhabiting in the Lower and Upper Subansiri District of Arunachal Pradesh and they are reported as rich in traditional culture and ethnobotanical knowledge heritage (Yakang et al., 2013; Murtem and Pradeep, 2016; Rinyo, 2018). The digestive and gastrointestinal diseases are reported as one of the major contributing factors for high rate of human mortality across the world in both developed and developing countries including India (WHO, 2020). The most common digestive disorders identified in the rural and urban localities of Arunachal Pradesh of North East India include

dysentery, diarrhea, indigestion, acid reflux and gastritis, and they are mostly treated by using traditional herbal medicines as major remedies in the rural localities (Kala, 2005; Jambey et al., 2017). The Apatani and the Tagin tribes of Arunachal Pradesh are belonging to Mongoloid racial stocks and they fall within the Tibeto-Burman linguistic group. They are predominantly found in the tropical, subtropical and temperate region of Lower and Upper Subansiri district located at the elevation ranging between 400 m – 3200 m from mean sea level (Ashan, 2006; Palaniappan, 2019). However, they are vulnerable to tropical borne diseases including dysentery, diarrhea and gastrointestinal disorders due to microbial infections and some other causes (Tag et al., 2008; Rinyo et al., 2018). Present study enumerates medicinal plants used by the Apatani and Tagin tribes of Arunachal Pradesh for the treatment of stomach and digestive related disorders.

## 2. Materials and methods

### 2.1. Study site and ethnomedicobotanical field survey

Ethnomedicobotanical field survey was conducted during the year 2020 – 2021 in the selected localities of the Apatani dominated Ziro Valley and the Tagin dominated Upper Subansiri district of Arunachal Pradesh (Figure 1) and documented their medicinal plant resources used for the treatment of stomach disorders following the method suggested by Martin (1995). A total of 35 key informants (15 from Apatani and 20 from Tagin tribe) were interviewed from 6 villages. We visited 3 villages in the Apatani dominated area in Lower Subansiri, namely, Siiro, Hija and Lempia [27.63°N 93.83°E], and another 3 villages, namely, Riddi, Limeking and Radding [28.3349° N, 93.9878° E] were visited in the Tagin dominated area of Upper Subansiri district of Arunachal Pradesh. The ethnomedicinal information was gathered using semi-structured questionnaire format, open ended interview and transect walk in the community forest with the traditional herbal healers. The local names, medicinal



**Figure 1.** Map showing location of study site where Tagin and Apatani tribes inhabit Lower Subansiri and Upper Subansiri District of central Arunachal Pradesh, North East India.

usage, parts harvested and herbal formulation methods were recorded in the field notebook and semi-structured questionnaire format. The voucher specimens were collected from community forest area. The specimens were dried and pasted in the herbarium sheet bearing collection number, place and date of collection following Jain and Rao (1977) method. Digital photographs were taken for each species using Nikon CoolPix Camera (Model No.: Coolpix P900). Voucher specimen were identified by consulting district flora, namely, *Flora of Lower Subansiri District, Arunachal Pradesh (India)* Vol. 1 & 2 by Pal (2013), and *Flora of Kurung Kumey District, Arunachal Pradesh* by Dash & Paramjit (2017). The accepted name and distribution range were verified in POWO: Plant of the World Online (<https://powo.science.kew.org/>). The voucher specimens were deposited in the Herbarium of Arunachal University (HAU), Department of Botany, Rajiv Gandhi University, Rono Hills, Doimukh-791112, Arunachal Pradesh for future reference.

## 3. Results

### 3.1. Enumeration of ethnomedicinal plants

Present studies have recorded 16 species of ethnomedicinal plants used by the Apatani (Ap) and the Tagin (T) tribes of Arunachal Pradesh for the treatment of stomach and digestive disorders which are enumerated as follows:

1. *Acmella oleracea* (L.) R.K. Jansen  
Family: Asteraceae  
Collection: HAU/RR/820/21.02.2021/Lempia  
Habit and habitat: Herb; subtropical and tropical  
Local name: *Yorkhung hamang* (Ap)/*Marcha* (T)  
Traditional uses: Leaves and stem are taken as remedy for constipation and severe gastritis.

2. *Allium tuberosum* Rottler ex Spreng.  
Family: Amaryllidaceae  
Collection: HAU/RR-936/10.06.2020/Hija  
Habit and habitat: Herb; subtropical  
Local name: *Lepi hamang* (A)  
Traditional uses: Leaves are taken in raw form as stimulant and used as remedy for gastritis and indigestion.
3. *Allium hookeri* Thwaites  
Family: Amaryllidaceae  
Collection: HAU/RR- 910/04.05.2020/Lempia  
Habit and habitat: Herb; subtropical  
Local name: *Taley* (Ap), *Talap* (T)  
Traditional uses: Leaves and roots are taken in raw form as stimulant and used as remedy for gastritis and indigestion.
4. *Begonia aborensis* Dunn  
Family: Begoniaceae  
Collection: HAU/RR-MT827/04.05.2020/Radding  
Habit and habitat: Herb; tropical  
Local name: *Rebe* (Ap)  
Traditional uses: Petiole are harvested and peel are removed and then taken orally in raw form as remedy for gastritis, indigestion, low appetite and mouth ulcer.
5. *Cardamine hirsuta* L.  
Family: Brassicaceae  
Collection: HAU/RR-903/25.08.2020/Lempia  
Habit and habitat: Herb; tropical and subtropical  
Local name: *Padw hamang* (Ap)/*Roji-romi* (T)  
Traditional uses: Whole plant are taken in both raw and boil form to relieve gastritis.
6. *Crassocephalum crepidioides* (Benth.) S. Moore  
Family: Asteraceae  
Collection: HAU/RR-MT884/25.08.2020/Riddi  
Habit and habitat: Herbs; tropical and subtropical  
Local name: *Genda*, *Kochi*, *Halyang hamang* (Ap)/*Ingkayeng* (T)  
Traditional uses: Fresh and cooked leaves are taken as remedy for severe constipation.
7. *Centella asiatica* (L.) Urb.  
Family: Apiaceae  
Collection: HAU/RR-MT884/28.07.2021/Radding  
Habit and habitat: Herb; tropical and subtropical  
Local name: *Ngilyang Khiko hamang* (Ap)  
Traditional uses: Fresh and decoction of leaves are taken as remedy for gastritis, dysentery and indigestion.
8. *Diplazium esculentum* (Retz.) Sw.  
Family: Aspleniaceae  
Collection: HAU/RR-MT866/28.06.2021/Hija  
Habit and habitat: Herb, tropical and subtropical  
Local name: *Hwka hamang* (Ap)/*Pakyaraya* (T)  
Traditional uses: Tender leaves are boiled and soup are used for treatment of digestive problems, liver disorders and also taken during constipation.
9. *Houttuynia cordata* Thunb.  
Family: Saururaceae  
Collection: HAU/RR-MT870/07.06.2021/Lempia  
Habit and habitat: Herb; tropical and subtropical  
Local name: *Siya hamang* (Ap)/*Hungna*, *honyga* (T)

- Traditional uses: Raw as well as decoction of whole herb is used for treatment of indigestion, dysentery, diarrhea and lung inflammation.
10. *Magnolia champaca* (L.) Baill. ex Pierre  
Family: Magnoliaceae  
Collection: HAU/RR-929/10.07.2021/Lempia  
Habit and habitat: Tree; subtropical  
Local name: *Salyo* (Ap)  
Traditional use: Seeds are used for treatment of stomach ache and indigestion.
  11. *Oenanthe javanica* (Blume) DC.  
Family: Apiaceae  
Collection: HAU/RR-917/15.08.2020/Hija  
Habit and habitat: Herb; subtropical  
Local name: *Hugung hamang* (Ap)/*Aguhama* (T)  
Traditional Use: Raw leaves are taken during gastric pain and indigestion
  12. *Oxalis corniculata* L.  
Family: Oxalidaceae  
Collection: HAU/RR-906/18.05.2021/Lempia  
Habit and habitat: Herb; Tropical and subtropical  
Local name: *Okhui hamang* (Ap)  
Traditional uses: Raw and decoction of leaves are taken to treat stomach ache, dysentery and diarrhea, and also used as appetizer.
  13. *Plantago asiatica* L.  
Family: Plantaginaceae  
Collection: HAU/RR/907/22/06/2020/Limeking  
Habit and habitat: Herb; subtropical  
Local name: *Mepi Hamang* (Ap)/*Talak O* (T)  
Traditional uses: Fresh leaves are cooked and taken during stomach ache, indigestion and constipation.
  14. *Paederia foetida* L.  
Family: Rubiaceae  
Collection: HAU/RR/1031/10.07.2021/Riddi  
Habit and habitat: Climber; tropical, subtropical  
Local name: *Upteer nemi* (T)  
Traditional uses: The fresh juice extracts are taken during diarrhea and dysentery. Leaves are cooked and consumed as vegetables.
  15. *Rhus chinensis* Mill.  
Family: Anacardiaceae  
Collection: HAU/RR-937/14.08.2021/Siirro  
Habit and habitat: Tree; tropical, subtropical  
Local name: *Tamo* (Ap)/*Tangme* (T)

Traditional uses: Ripen fruits are taken during gastritis and dysentery.

16. *Thladiantha ziroensis* Yanka H & Arup K. Das  
Family: Cucurbitaceae  
Collection: HAU/RR939/16.08.2021/Lempia  
Habit and habitat: Climber; subtropical  
Local name: *Rwko* (Ap)/*Rwk* (T)  
Traditional uses: Dried stem are chopped into pieces and ground to powder and then mixed with hot water and taken orally to treat dysentery, gastric trouble, and low appetite.

#### 4. Discussion

Present investigation revealed 16 species of medicinal plants belonging to 14 genera and 12 angiosperm plant families and 01 pteridophyte family used by the traditional herbalists of the Apatani and the Tagin tribes for the treatment of stomach related disorders. Majority of the medicinal plant species (14 sp.) reported were herbs. 01 tree species (*Rhus chinensis*) of Anacardiaceae and 01 climber species (*Thladiantha ziroensis*) of Cucurbitaceae were found occasionally harvested for medicinal purposes. The whole plant of *Houttuynia cordata* (Figure 2) was found frequently harvested and used for the treatment of variety of ailments such as pneumonia and skin diseases, and also used as blood purifier among the Apatani and Tagin tribes.

In the present study, a maximum of 9 and minimum of 3 stomach related disorders were found treated by a total of 35 herbalists belonging to age group 15 – 90 years using all 16 species of medicinal plants recorded from both the Apatani and Tagin tribes irrespective of their age and gender (Table 1). Furthermore, a minimum of 5 and maximum of 16 species of medicinal plants were found used by both male and female informants recorded under age group between 15-90 years. Under male informant category, a minimum of 7 and maximum of 16 species were used while in the female informant category, a minimum of 5 and maximum of 16 species of medicinal plant species were used for the treatment of 3 – 9 types of stomach related disorders. It was also observed that both male and female informants (herbalists) of both the Apatani and Tagin tribes were equally skilled and competent in plant identification and diagnosis of digestive diseases leading to effective treatment.

Literature corroboration also confirmed that majority of the herbs such as *Allium hookeri*, *Centella asiatica*, *Crassocephalum crepidioides*, *Plantago asiatica*, and *Paederia foetida* reported in the present studies are also reported by the previous workers as anti-oxidant, anti-inflammatory, anti-diabetic, anti-ulcer, anti-cancer, anti-diarrhea, anti-dysentery, anti-septic and wound healing agents by the tribal herbal healers of Arunachal Himalayan region (Tag and Das, 2007; Tag et al., 2012; Jambey et al., 2017). Recently, two bioactive phytochemicals, namely, the 6-Hydroxyondansetron and Quercitrin have been identified from *Houttuynia cordata* which inhibits three replication proteins of SARS-CoV-2, that is, Main protease (Mpro), Papain-Like protease (PLpro) and ADP ribose phosphatase (ADRP) which control the DNA replication of corona virus (Sanjib et al., 2022). *Centella asiatica* was reported as blood purifier, appetizer, and found effective against diarrhea, leprosy and tuberculosis (Yakang et al., 2013). *Allium hookeri* was reported for the treatment of allergies, skin eruptions, skin inflammation and livestock diseases while *Magnolia champaca* was reported as stimulant

Informant Category	Frequency of age (Years)	No. of informants	No. of stomach disorders treated	No. of plant species used
Male	15 – 30	3	4	12
	30 – 45	7	6	15
	45 – 60	4	8	16
	60 – 75	1	5	07
	75 – 90	2	7	13
Female	15 – 30	2	3	05
	30 – 45	5	6	11
	45 – 60	7	9	16
	60 – 75	2	8	10
	75 – 90	1	3	05

**Table 1.** Age frequency of the key informants (n=35) interviewed, number of stomach disorders treated and number of plants species recorded for treatment of each disorder category from Apatani and Tagin biocultural landscape of Lower and Upper Subansiri district of Arunachal Pradesh.

and appetizer, and also used as remedies for liver disorders among the Apatani tribe (Kala, 2005; Srivastava, 2010).

Stem of *Thladiantha ziroensis* was reported to be used against throat pain, cough and cold, and infections (Yanka et al., 2017). Flowers and leaves of *Acmella oleracea* have been reported as appetizer, and alternatively used for the treatment of tooth ache, and also used for deworming of the intestinal worms (Kala, 2005; Yakang et al., 2013). Leaves of *Plantago asiatica* was reported as blood coagulating agent and also used for the treatment of freshly cuts and wounds (Yakang et al., 2013). The saponin and tannin rich *Diplazium esculentum* was found commonly consumed among the local residents as vegetable and the decoction are orally taken for the treatment of liver and lose motion.

*Thladiantha ziroensis* was another rare but medicinally useful species observed in the secondary and primary dense forest floor. The stem climber was found harvested by traditional herbalists and then smock dry, and the decoctions were used as digestive tonic, appetizer, and also used for the treatment of diarrhea and dysentery.

There is a need for conservation of these rare plant species of immense medicinal and economics significance through conservation of community forest land in the Tagin and Apatani biocultural landscape for cheap and affordable rural healthcare and sustenance of community livelihood.

## 5. Conclusion

Present investigations have identified 9 types of stomach related disorders prevalent among the Apatani and Tagin tribes living in tropical, subtropical and temperate region of Lower and Upper Subansiri district of Arunachal Pradesh. In the absence of modern health care facilities in the rural localities, the local residents collect medicinal plants of their localities including these 16 species of both wild and cultivated medicinal plants, mostly herbs which are primarily used for the treatment of stomach and digestive disorders ranging from diarrhea, dysentery, constipation, indigestion, gastric ulcer, gastritis and acid reflux and liver diseases. The four species, namely, *Allium hookeri*, *Diplazium esculentum*, *Houttuynia cordata* and *Acmella oleracea* have been identified as commercially viable species regularly sold in the local vegetable market and have been found potential to ensure rural livelihood security. *Thladiantha ziroensis* was found rare in their natural habitat which need conservation priority. Present studies concluded that majority of the medicinal plant species documented from the Tagin and Apatani biocultural landscape are wild and edible which are commonly sold in the rural and urban market. Further studies are needed to unveil the bioactive phytochemicals responsible for effective treatment of the digestive and gastrointestinal diseases reported in present studies.

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## Authors' contributions

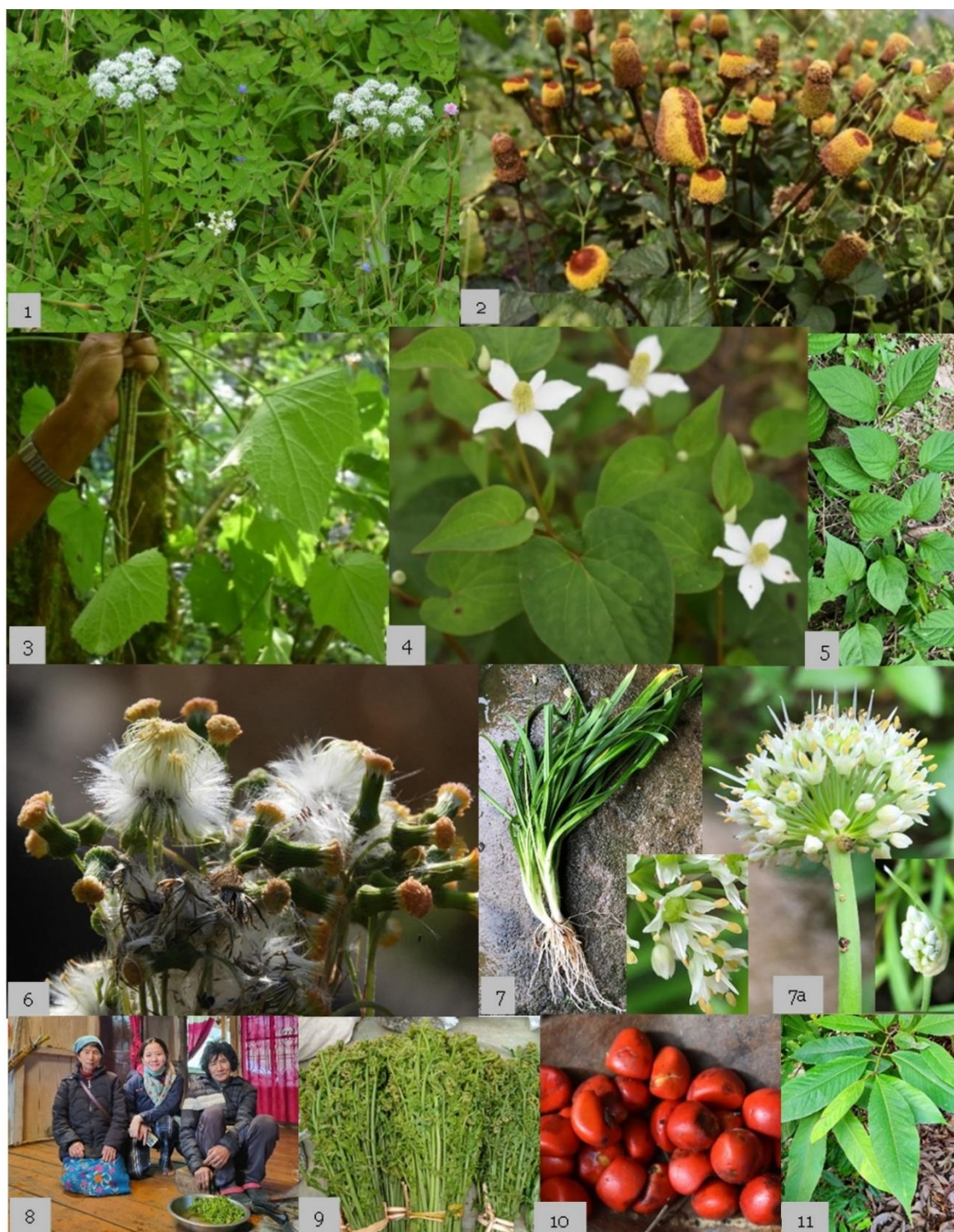
The first author (RR) generated the field data and prepared the draft manuscript. The second and the third authors (PKH and HT) are Ph.D. supervisors and mentors who formulated the research design and contributed for intellectual approach, and critically reviewed and finalized the draft manuscript.

## Conflict of interests

The authors have no conflict of interest.

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**Figure 2.1.** *Oenanthe javanica* (Apiaceae); **2.** *Acemella oleracea* (Asteraceae); **3.** *Thladiantha ziroensis* (Cucurbitaceae); **4.** *Houttuynia cordata* (Saururaceae) with flowers; **5.** *Paederia foetida* (Rubiaceae), a tropical climber popularly used as anti-diarrhea and anti-dysentery agent. **6.** *Crassocephalum crepidioides* (Asteraceae); **7.** *Allium hookeri* (Amaryllidaceae) with roots and leaves; **7a.** Inflorescence of *Allium hookeri* with closeup view of individual flower showing tepals, ovary, stamen with anthers and carpels; **8.** Scholar with village herbalists; **9.** *Diplazium esculentum* (Aspleniaceae) harvested and sold in the local market. **10.** Seeds of *Magnolia champaca* (Magnoliaceae); **11.** Branch of *Magnolia champaca*.

