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Ethnomedicinal plant diversity for gastrointestinal disorders in Kodagu district of Western Ghats

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Abstract
The gastrointestinal tract is one of the most important organs of the human body and is vulnerable to different diseases. The traditional culture and the natural ecosystem of Kodagu region have been relatively well conserved. Since orally transmitted traditional knowledge is possessed by older generation, most of it can disappear drastically following their deaths. The aim of this study was to record and analyse orally transmitted traditional knowledge about the treatment of digestive system disorders. During our survey 22 species used for the treatment of gastrointestinal disorder were recorded. Interaction with traditional medicinal practitioners of the tribes and information gathered from them have revealed that effective healing has been resulted by the usage of the recorded species. The plant parts used, the therapeutic formulations, mode of administration adopted and practised are detailed in the present study.

Keywords: Ethnobotany, gastrointestinal disorders, medicinal plants, Kodagu

1. Introduction
Gastrointestinal disorders have a high prevalence in human societies and have a substantial effect on worldwide morbidity and mortality rates. They are ailments affecting the functions of the digestive tract, i.e., food and liquid absorption, digestion, or excretion (Neamsuvan *et al*., 2012) [5]. The World Health Organization (WHO) reported that digestive system disorders, particularly diarrhoea, was the second leading cause of global mortality in children under five years old and was responsible for deaths of 370,000 children in 2019. Herbal medicines have been in use since time immemorial and are still the mainstay mainly in the developing countries because of their better cultural acceptability, better compatibility with the human body and lesser side effects while the use of complementary and alternative medicine is increasing rapidly in developed countries (Kagyung *et al*., 2009). A gradual diminishing ethnomedicinal knowledge in the region is observed owing to unwillingness to share the knowledge by the tribes and lack of interest among younger generations to explore, develop and document the traditional knowledge. In view of the significance of this invaluable knowledge, present study was carried out in the Western Ghats region of Kodagu district.

2. Methodology
This study was undertaken during January 2022 to April 2022 at different tribal settlements of Kodagu district. Major scheduled tribes of Kodagu are Erava, Kaadu Kuruba, Jenu Kuruba, Betta Kuruba and ethnic groups like Kodava and Amma Kodava. Basic information on the distribution of the selected tribes was collected from Tribal development offices in Taluk headquarters of the district. A semi-structured questionnaire was prepared to collect information pertinent to the therapeutic uses of medicinal plants from the tribes, local Vaidyas, and traditional medicinal healers. Data on the plant species, vernacular/local names, family, habit, parts used, IUCN status, therapeutic uses and mode of administration are compiled and detailed in Table 1. The plant species were identified using available field keys, authentic literatures and with the help of taxonomists at University of Mysore.

3. Results and Discussion
A total of 22 plant species distributed in 17 families were found to be used locally for treating various gastrointestinal disorders including diarrhoea, dysentery, gastritis, food poison, ulcer, stomach ache, jaundice, kidney stone and vomiting.

Of the documented species, Asteraceae was the dominant family having three species, followed by two each in Acanthaceae, Phyllanthaceae and Fabaceae. One species each was recorded in other families (Figure 1). The high number of species from Asteraceae is attributed to the large number of its bioactive compounds (Tugume *et al*., 2019) [11]. Herbs formed the highest proportion of medicinal plant species (34%) followed by shrubs (27%), trees (24%) and climbers (10%) (Figure 2). The various plants parts used in traditional medicine preparation includes fruits, leaves, roots, seeds, stems, flowers, bark and in some cases whole plants are used. Among the parts used for treatment leaves are the most commonly used plant part having 46% usage followed by root (13%). The use of other plant parts was less common and in the range of 4-5% (Figure 3). The prevalence of use of leaves for the preparation of medicine is because of their potency and fast regeneration ability. They are the main photosynthetic organs and also act as storage for exudates or photosynthates; some of which are of medicinal value (Ahmad *et al*., 2014) [1]. Their dominant use could also be attributed to the ease with which they are harvested. The major methods of preparation of plant extracts are paste, infusion, juice and decoction (Figure 4). Water was the main solvent used in preparation of herbal therapies. Concoctions involved mixing water with an assortment of different plant species. Pastes are commonly used (33%) and are prepared by grinding plant materials in a specific quantity and consumed with a suitable medium. Pastes are followed by infusions (24%) that involved pouring hot/warm water onto the plant material and allowing the mixture to cool. Some diseases are treated using a single plant species and in other cases a mixture of plant parts from different species are used. The use of more than one plant or plants' parts in herbal preparations could be attributed to the fact that the traditional medicines may only be active in combination due to the synergistic effects of several compounds that are acting singly (Olajuyigbe *et al*., 2012) [6].

Table 1: Ethnomedicinal plants used for the treatment of gastrointestinal disorders

Sl. No.	Scientific Name	Vernacular Name	Family	Plant Habit	Parts Used	Therapeutic Use/ Mode of administration	Tribe/Ethnic groups	IUCN Status
1	*Ardisia solanacea* (Poir.) Roxb.	Pottiche	Primulaceae	Shrub	Leaves	**Gastritis:** Leaves are infused in boiling water and consumed orally for 3 days in empty stomach.	Erava	NE
2	*Eriobotrya japonica* (Thunb.) Lindl.	Kona ber	Rosaceae	Tree	Root	**Dysentery:** Root is ground into a paste and consumed along with lemon juice for two times.	Erava	NE
3	*Cryptolepis buchananii* Roemer & Schultes	Choori pann	Asclepiadaceae	Climber	Fruits	**Gastritis:** Fruits are ground, infused in boiling water and one teaspoon of it is consumed early in the morning with empty stomach.	Amma Kodava	NE
4	*Abelmoschus moschatus* Medk.	Jenu kaai	Malvaceae	Herb	Seeds	**Food poison:** Seeds are ground and taken along with water.	Jenu Kuruba	NE
5	*Alangium salviifolium* ssp. hexapetalum	Nakkole mara	Cornaceae	Tree	Bark	**Food poison:** 10g of bark is ground and powdered, mixed with 900ml of raw milk and consumed orally at once, early morning with empty stomach. This medicine is given only on Sunday.	Kodava	NE
6	*Asparagus racemosus* Willd.	Shathavari	Asparagaceae	Climber	Leaves	**Liver disease:** Leaf extract along with cumin seeds, red rocksugar and raw milk is consumed orally for 3 days early morning in the empty. Specific diet has to be maintained.	Amma Kodava	VU
7	*Chromolaena odorata* (L.) R.M. King & H. Rob.	Gandhi gulabi	Asteraceae	Shrub	Leaves	**Gastric ulcer:** These leaves along with leaves of *Phyllanthus amarus* and *Andrographis paniculata* is ground and the juice is consumed.	Kodava	NE
8	*Clitoria ternatea* L.	Shanka Pushpa/ Krishnapushpa	Fabaceae	Vine	Flower, Leaves	**Stomach ache or related complications:** These leaves along with leaves of *Phyllanthus amarus* and *Andrographis paniculata* are ground together and the extracted juice is consumed.	Kodava	NE
9	*Cyclea peltata* Hook. f. & Thoms.	Paavade balli/ Punje mott balli	Menispermaceae	Climber	Root, Leaves	**Food poison:** Root is ground with betel leaves and raw milk and consumed orally, early morning in empty stomach for 7 days.	Kodava	NE
10	*Dendrophthoe falcata* (L.f.) Ett.	Bandhalakki	Loranthaceae	Parasitic subshrub	Leaves	**Food poison:** Leaves along with few rice grains are ground together with water and consumed for 7 days with strict diet.	Kodava	NE
11	*Eclipta alba*	Bringaraja	Asteraceae	Herb	Leaves	**Jaundice:** Tender leaves are infused in boiling water along with salt, pepper and lemon juice and consumed two times a day for 3 days in empty stomach.	Kodava	LC
12	*Graptophyllum pictum* (L.) Griffith		Acanthaceae	Shrub	Leaves	**Kidney stone:** Leaves are crushed and the juice obtained is mixed with sour buttermilk and consumed.	Amma Kodava	NE
13	*Hygrophila auriculata* Schumach.	Kola thoppu, Kolavalike thoppu	Acanthaceae	Herb	Whole Plant	**Kidney stone:** One fist of the tender part of the plant along with salt, pepper is infused in boiling water and few drops of lemon juice is added and consumed orally, three times a day until symptom reduces.	Kodava	LC
14	*Jatropha curcas* L.	Kaachi	Euphorbiaceae	Shrub	Sap	**Vomiting, Stomach ache, Bloody diarrhoea:** 5ml to 10ml of the latex is collected early in the morning and add 3-4 times water, mix well and drink with empty stomach, early morning for 2 days.	Betta Kuruba	LC
15	*Kalanchoe pinnata* (Lam.) Pers	Potichike	Crassulaceae	Herb	Leaves	**Kidney stone:** Three leaves are ground with red rock sugar and raw milk, which is taken for 3 to 4 days in empty stomach.	Erava	NE

16	*Musa paradisiaca* L.	Boodha bale mara	Musaceae	Herb	Stem	**Gallbladder stone:** The sap from the inner part of the stem is extracted by smashing it and is consumed along with tender coconut water until the symptom reduces.	Betta Kuruba	NE
17	*Phyllanthus amarus* Schumach. & Th onn.	Kiru nellige, nela nelli	Phyllanthaceae	Herb	Leaves	**Jaundice:** 8-10 of these tender leaves along with one fist of *Centella asiatica* leaves, few leaves of *Azadirachta indica*, *Leucas aspera* leaves and 1/4ltr of raw milk ground together and consumed orally for 3 days, early morning in empty stomach. Specific diet has to be maintained.	Kodava	NE
18	*Phyllanthus emblica* L.	Nellige mara	Phyllanthaceae	Tree	Bark	**Bloody diarrhoea:** Shreds of bark is soaked in water and the extract obtained is mixed with buttermilk. One cup of it is taken 3 times a day.	Kodava	LC
19	*Scoparia dulcis* L.	Kallurki, Kaad sambaara	Plantaginaceae	Herb	Leaves	**Kidney stone:** Few leaves are ground and made into powder along with *Kalanchoe pinnata leaves* and consumed with raw milk for 3 days in empty stomach, early morning. Specific diet has to be maintained.	Kaad Kuruba	NE
20	*Smithia sensitive* Aiton	Muttidare muni	Fabaceae	Herb	Whole plant	**Stomach ailments:** Leaves are used in the treatment.	Kaad Kuruba	LC
21	*Spilanthes paniculata* Wall. ex DC.	Poomoggu	Asteraceae	Herb	Flowers	**Increase appetite:** 2-3 flowers are consumed directly.	Amma Kodava	LC
22	*Thottea siliquosa* (Lam.) Ding Hou	Chakrani ber	Aristolochiaceae	Shrub	Root	**Vomiting and diarrhoea:** Root is ground into a paste with lemon juice and two spoons are taken 3 times a day. (The upper part of the root is used to treat vomiting and the lower part for diarrhoea)	Kodava	NE

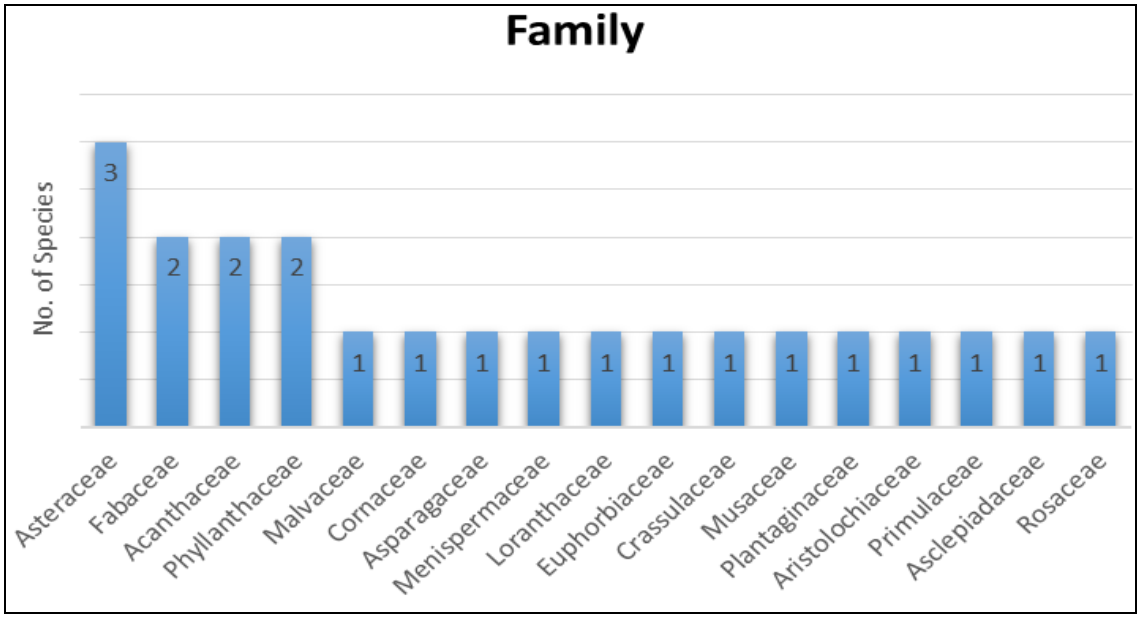

Fig 1: Number of species from different botanical family used for the treatment of gastrointestinal disorders

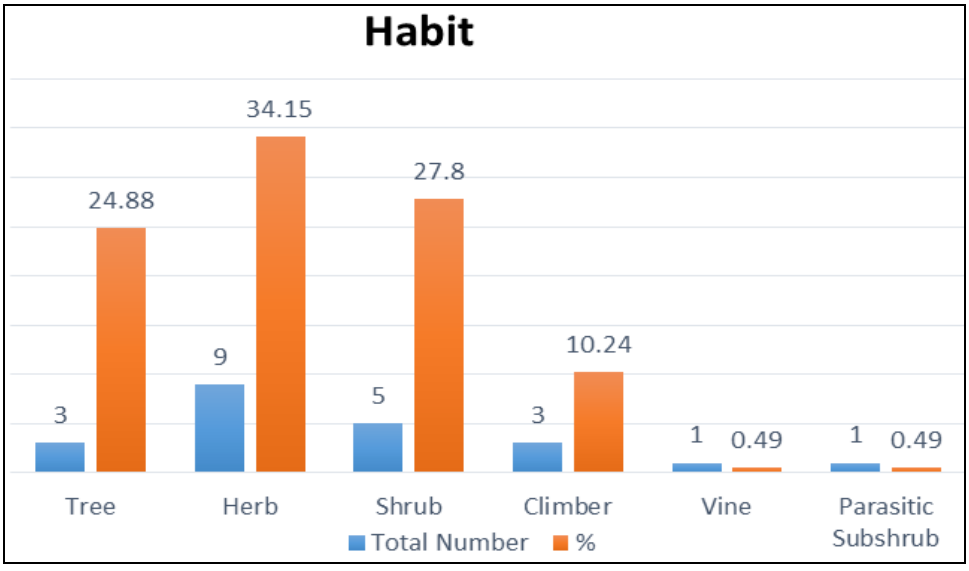

Fig 2: Ethnomedicinal plant habits (in number and percentage)

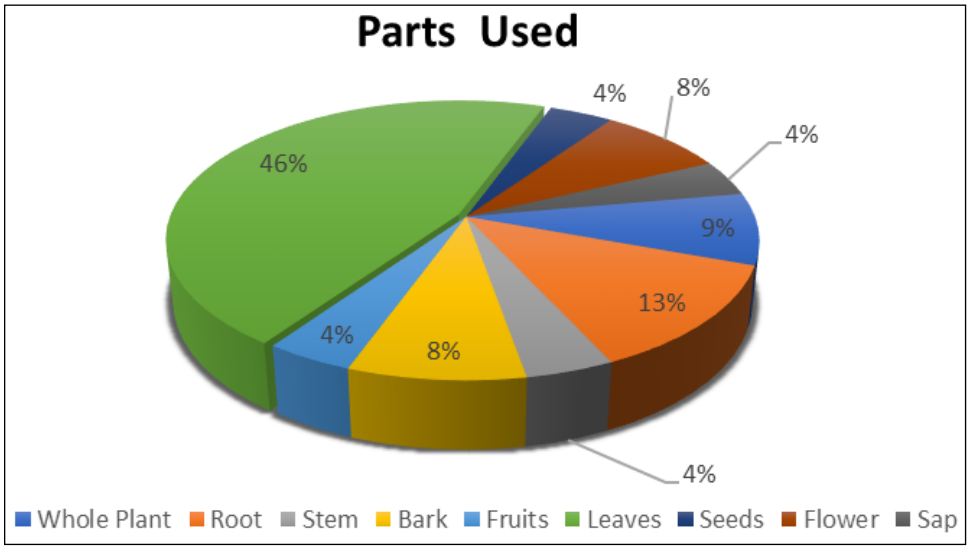

Fig 3: Percentage of various plant parts used in therapeutic applications

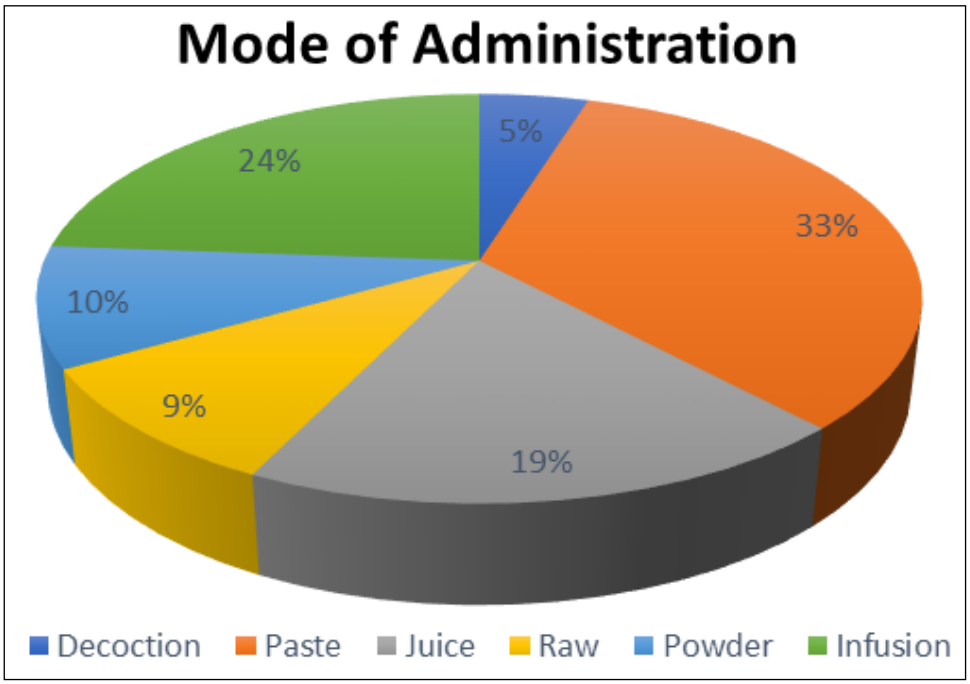

Fig 4: Percentage of various modes of administration of medicinal plants

Ardisia solanacea

***Eriobotrya japonica* (Thunb.) Lindl.**

Alangium salviifolium* ssp. *Hexapetalum

Cyclea peltat

Asparagus racemosus

Clitoria ternatea

Phyllanthus amarus

Thottea siliquosa

Hygrophila auriculata ***Kalanchoe pinnata***

Fig 5: Plants used in the treatment of gastrointestinal disorders

4. Conclusion

Medical facilities for the inhabitants are considerably not easily accessible as the houses in Kodagu are located in interior areas of the district. The people are still dependent on plants in their immediate surrounding for food and medicine. The traditional knowledge of plants use thus gained over a period of time is basically transferred from generation to generation to cure diseases and to derive other benefits. While the loss of valuable medicinal plants due to population pressure, agricultural expansion and deforestation have been widely reported, documenting indigenous knowledge becomes essential to preserve the traditional knowledge and can be lost whenever a traditional medical practitioner passes without conveying (Olajuyigbe *et al*., 2012) [6]. Present study unravels the relevance of plant species in treatment of various gastrointestinal disorders. Further research work has to be carried out for the scientific validation of the traditional herbal therapy and deduce an appropriate dosage for curing various gastrointestinal disorders.

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