



## American-Eurasian Journal of Sustainable Agriculture

JOURNAL home page: <http://www.aensiweb.com/aejsa.html>

2013 December; 7(5): pages 403-414

Published Online 2014 February 15.

Research Article

### Ethnomedicinal Plants of the Rai Clan of the Tipra Tribe of Sylhet District, Bangladesh

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**Received:** November 03, 2013; **Revised:** January 13, 2014; **Accepted:** January 17, 2014

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#### ABSTRACT

The Rai clan of the Tipra tribe can be found inhabiting Boteshwar village in Sylhet district of Bangladesh. Since the traditional medicinal practices of this clan have hitherto been not reported, it was decided to conduct an ethnomedicinal survey among this clan. The clan had only one practicing traditional healer, suggesting that traditional medicinal practices are dying out. The healer was found to use a total of 66 plant species distributed in to 39 families for medicinal purposes. The various ailments treated by the healer included respiratory disorders, gastrointestinal disorders, pain, tooth infection, skin disorders, fever, weakness of the body, sexual weakness, ear infections, spleen enlargement, diabetes, oral lesions as well as lesions on the tongue, eye infections, rheumatism, leprosy, filariasis, urinary problems, snake bite, piles, anemia, menstrual problems, swelling of veins, helminthiasis, hair loss, burning sensations in body, puerperal fever, and abnormal heart palpitations. From the number of plants used, it appeared that gastrointestinal disorders, pain, respiratory disorders, and skin disorders were the major ailments suffered by the clan population. Gastrointestinal disorders were treated with 9 plant species, pain with 8 plant species, skin disorders with 6 plant species, and respiratory disorders with 5 plant species. On the basis of available scientific evidences, the use of a number of plants by the healer can be seen to have scientific validations, suggesting that the healer had quite extensive knowledge on the medicinal properties of plants that he used. Some diseases that cannot be cured with modern allopathic medicine like diabetes and rheumatism were also treated by the healer. Further investigations on the plants used by the healer therefore merits further scientific investigations toward possible discovery of newer and better drugs.

*Key words:* Tipra, Rai clan, medicinal plants, Sylhet, Bangladesh

#### INTRODUCTION

Indigenous societies try to live in a state of harmony with nature and procure their various materials, which they need for food, clothing, housing and treatment for illnesses, from their surroundings. Various reports show that the indigenous communities, even in these days of allopathic medicine, still rely on their own traditional healers for fulfillment of their therapeutic needs. Although such traditional practices used to be dismissed by allopathic practitioners as being mere quackery, in recent years the realization has dawned that traditional healers may possess considerable knowledge on the materials that they use for treatment, the foremost among them being medicinal plants. The knowledge of traditional healers is

usually passed on from generation to generation, and so over time, traditional healers can possess quite extensive knowledge on the medicinal properties of plants. In fact some traditional medicinal practices have been quite established within the Indian sub-continent and elsewhere. Practices like Ayurveda and Unani have been practiced in the Indian sub-continent for thousands of years; Chinese herbal drugs have recently gained attention from scientists all over the world for their healing abilities.

Many modern drugs have resulted from close observations of healing practices of indigenous communities [3,9,14]. Modern drugs like aspirin, atropine, ephedrine, digoxin, morphine, quinine, reserpine and tubocurarine are examples, which were originally discovered through observations of traditional cure methods of indigenous peoples.

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However, with few exceptions, most indigenous communities are rapidly changing because of the impact of mainstream society people and their dominant culture. The indigenous communities are fast losing their traditional habitat, converting to more dominant religions, adopting cultures of the majority population, and losing belief in their traditional medicinal healers. Thus traditional healers are not only becoming difficult to find, but with fewer apprentices undergoing training under the traditional healer, they are also losing their traditional medicinal knowledge. This is an unfortunate situation, for with the disappearance of this knowledge, scientists will lose an easy method for conducting appropriate therapeutic properties of any given medicinal plant.

Bangladesh is believed to have more than 100 indigenous communities or tribes. In the absence of actual field surveys, some anthropologists believe that the tribal communities may exceed 200. Most of these tribal communities are small and dwindling in numbers at a fast pace because of loss of their traditional means of livelihood, and being unable to find out new sources of living. As a result, their traditional medicinal practices are in danger of becoming lost forever, for studies on these tribes and particularly reports on their traditional medicinal practices are almost totally absent. Towards documentation of the traditional medicinal practices of particularly the small tribes, we had been conducting systematic ethnomedicinal surveys among the traditional medicinal practitioners of both the mainstream population as well as the tribal population for a number of years [35,38-40,8,19,21,32,33,41-47,1,5-7,18,24,25,50-55,57,59, 11,19,21,29]. Thus far, our studies have clearly demonstrated that the traditional use of particularly medicinal plants is not merely a matter of superstitious beliefs, but can be shown to be scientifically validated to a quite considerable extent on the basis of available scientific reports on those medicinal plant species.

The Tipra tribe (also known as the Tripura tribe) is an indigenous community of Bangladesh and can be found in a number of regions like Sylhet district in the northeastern region of Bangladesh and Chittagong Hill Tracts in the southeastern part of the country. The tribe also can be found in the neighboring Tripura State of India, which adjoins Bangladesh. The tribe is known to have several clans. Although some ethnomedicinal literature exists for the Tripuras in India as well as the Tiprahs or Tripuras of Bangladesh, not much is known about the traditional medicinal practices of the individual clans. We have previously documented the ethnomedicinal practices of the Harbang clan of the Tripura tribe inhabiting the Mirsharai area of Chittagong district in Bangladesh [48]. We have also documented the traditional medicinal practices of the Tripura people living in Comilla district of

Bangladesh [15]. The objective of the present survey was to document the ethnomedicinal practices of the Rai clan of the Tipra tribe inhabiting parts of Sylhet district in Bangladesh.

## Materials and Methods

The Rai clan of the Tipra tribe was located at Boteshwar village in Sylhet district of Bangladesh. The tribe had only one traditional healer, Tarani Prasad Rai, age 70 years, and practicing for 58-59 years. He claimed to be a 'gaibik', i.e. got all his treatment methods from the Creator at age 10-11 years. The total clan population was below 500, and most of the adults and quite a few children worked in the nearby Habib Tea Estate as agricultural laborers. Informed consent was initially obtained from the healer. The healer was apprised as to the nature of our visit and persuaded to divulge his knowledge of medicinal plants and their therapeutic uses. Consent was further obtained to disseminate any information provided in national and international publications.

Actual interviews were conducted with the help of a semi-structured questionnaire and the guided field-walk method of Martin [30] and Maundu [31]. In this method, the healer took the interviewers on guided field walks through areas from where he usually collected his medicinal plants, pointed out the plants, and described their uses. Plant specimens were photographed and collected on the spot, pressed, dried and brought back for complete identification at the Bangladesh National Herbarium. Voucher specimens were deposited at the Medicinal Plant Collection Wing of the University of Development Alternative. Detailed conversations with the healer took place in the evening in open-ended conversations where the healer discussed the medicinal uses of plants in more details.

## Results and Discussion

The healer was observed to use a total of 66 plant species in his formulations, which plant species were distributed into 39 families. Sylhet area is a biodiversity hotspot in Bangladesh regarding floral species, and several species were recorded from the healer, which are not much in use in other parts of Bangladesh. The various ailments treated by the healer included respiratory disorders, gastrointestinal disorders, pain, tooth infection, skin disorders, fever, weakness of the body, sexual weakness, ear infections, spleen enlargement, diabetes, oral lesions as well as lesions on the tongue, eye infections, rheumatism, leprosy, filariasis, urinary problems, snake bite, piles, anemia, menstrual problems, swelling of veins, helminthiasis, hair loss, burning sensations in body, puerperal fever, wet dream, and abnormal heart palpitations. The results are shown in Table 1.

**Table 1:** Medicinal plants and formulations of the Rai healer.

Serial Number	Scientific Name	Family Name	Local Name	Parts used	Disease, Symptoms, Formulations, and Administration
1	<i>Adhatoda vasica</i> Nees	Acanthaceae	Bashok	Leaf	Dry cough. Ten leaves of <i>Adhatoda vasica</i> are combined with 10 fruits of <i>Piper nigrum</i> , 10 flower buds of <i>Syzygium aromaticum</i> , 10 fruits of <i>Piper peepuloides</i> , and 1 tola (local measure, 80 tolas approximate 1 kg) of <i>Solanum surattense</i> fruits. The mixture is crushed together and boiled in ½ kg water till total weight is about 200g. The decoction is then strained and the liquid part taken orally thrice daily till cure.
2	<i>Andrographis paniculata</i> Burm. f.	Acanthaceae	Kalomegh	Leaf	Constipation. Juice obtained from crushed leaves is orally taken with honey. Stomach pain. Juice obtained from crushed leaves of <i>Andrographis paniculata</i> is combined with bark of <i>Cinnamomum verum</i> , fruit of <i>Elettaria cardamomum</i> , floral bud of <i>Syzygium aromaticum</i> , and fruit of <i>Piper nigrum</i> and orally taken.
3	<i>Mangifera indica</i> L.	Anacardiaceae	Aam	Bark	See <i>Echinochloa stagnina</i> .
4	<i>Spondias pinnata</i> (L. f.) Kurz.	Anacardiaceae	Amra	Gum, whole plant	Blood dysentery. Juice obtained from crushed whole plant is mixed with gum of the plant and taken orally with sugar.
5	<i>Centella asiatica</i> (L.) Urb.	Apiaceae	Thankuni	Leaf	Headache. Juice obtained from crushed leaves is orally taken with milk. Stuttering in children. Juice obtained from crushed leaves is first warmed. After cooling, the cold juice is taken orally with cold milk and honey.
6	<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	Chatim	Gum	Tooth infection. Gum is applied to the infected tooth.
7	<i>Catharanthus roseus</i> (L.) G. Don.	Apocynaceae	Nayantara	Leaf, young stem	Severe skin infection. Juice obtained from crushed leaves and young stems is used for washing the infected area(s) for 7-8 days.
8	<i>Wrightia tinctoria</i> (Roxb.) R. Br.	Apocynaceae	Indrajari, Indrajal	Root	Asthma (symptoms: greater respiratory difficulties during night of full moon or night of no moon). Roots are hung around the throat like an amulet. Note that when respiratory difficulties occur, the healer advised catching a live toad, tying the toad with a thread in front of the patient, and then releasing the toad in the center of a 3-road section. The time the toad spends hopping, the respiratory difficulties will lessen.
9	<i>Alocasia indica</i> (Roxb.) Schott	Araceae	Maan kochu	Whole plant except for the rhizome and roots	Rheumatic pain (symptoms: joint pain). Whole plant is cooked with what are considered as 'hot spices', namely clove (flower bud of <i>Syzygium aromaticum</i> ), bay leaf (leaf of <i>Cinnamomum tamala</i> ), cinnamon (bark of <i>Cinnamomum verum</i> ), and cardamom (fruit of <i>Elettaria cardamomum</i> ) and oil and is eaten. This is continued for 7-15 days.
10	<i>Rhaphidophora pertusa</i> (Roxb.) Schott	Araceae	Aari kochu	Stem	Ear ache. Juice obtained from crushed stem is warmed. 1-2 drops of the warm juice is then internally applied to the ears.
11	<i>Aristolochia indica</i> L.	Aristolochiaceae	Ishwar mul	Bark, root	Stomach pain. Seven small pieces of bark is chewed and taken orally in the evening after meals and in the morning before breakfast. Note that taking too many bark pieces may lead to vomiting. See <i>Echinochloa stagnina</i> .
12	<i>Calotropis procera</i> (Aiton) W.T. Aiton	Asclepiadaceae	Akondo	Bark	Whole body pain. Bark of <i>Calotropis procera</i> is crushed with leaves of <i>Datura metel</i> and cloves of <i>Allium sativum</i> . The crushed mixture is warmed with 'ghee' (clarified butter) or mustard oil (oil obtained from seeds of <i>Brassica juncea</i> ) and massaged over the whole body. Note that latex of <i>Calotropis procera</i> can make a person blind if it gets into the eyes.

13	<i>Chrysanthemum coronarium</i> L.	Asteraceae	Chandra mukhi	Root	High fever with pain in bones. Roots are soaked in water overnight followed by drinking the water the following morning. This is continued till cure.
14	<i>Bombax ceiba</i> L.	Bombacaceae	Shimul	Root	Weakness, sexual weakness. Juice obtained from crushed roots is taken regularly orally. See <i>Echinochloa stagnina</i> .
15	<i>Heliotropium indicum</i> L.	Boraginaceae	Hatir shur	Leaf, flower	Ear infection. Juice obtained from crushed leaves and flowers is applied internally to the ears.
16	<i>Carica papaya</i> L.	Caricaceae	Pepe	Gum, fruit	Spleen enlargement. Gum is orally taken with sugar. Eczema. Gum is mixed with a small amount of lime (calcium hydroxide) and applied topically. Loss of appetite, indigestion, constipation. Ripe fruits are orally taken.
17	<i>Terminalia arjuna</i> (Roxb.) W. & A.	Combretaceae	Arjun	Bark, leaf	Bone pain. Juice obtained from crushed leaves and bark is mixed with mustard oil (oil obtained from seeds of <i>Brassica juncea</i> ) and applied over the painful areas. See <i>Echinochloa stagnina</i> .
18	<i>Terminalia chebula</i> (Gaertn.)	Combretaceae	Horitoki	Fruit	Weakness. Fruits of <i>Terminalia chebula</i> are taken orally with honey, pulp within the leaves of <i>Aloe vera</i> , and roots of <i>Glycyrrhiza glabra</i> .
19	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	Pathorkuchi	Leaf	Dysentery, indigestion. Leaf juice is taken orally with honey.
20	<i>Brassica juncea</i> (L.) Czern	Cruciferae	Shorisha	Seed oil	See <i>Calotropis procera</i> . See <i>Terminalia arjuna</i> .
21	<i>Coccinia indica</i> Wight & Arnold	Cucurbitaceae	Telakucha	Leaf, root	Diabetes, fever. Juice obtained from leaves and roots is taken orally twice daily in the morning and evening.
22	<i>Lagenaria siceraria</i> (Mol.) Standl.	Cucurbitaceae	Lau	Fruit	Leucoderma. Fruits are roasted over a fire followed by massaging the roasted fruit on the affected area(s).
23	<i>Dillenia indica</i> L.	Dilleniaceae	Chalta	Bark	Coughs, mucus. Powdered bark is orally taken with sugar and warm water. See <i>Echinochloa stagnina</i> .
24	<i>Diospyros peregrina</i> (Gaertn.) Gürke	Ebenaceae	Gab	Fruit	Oral lesions, skin infections. For oral lesions, fruit juice is mixed with water and the water used for gargling. For skin infections, fruits are boiled in water. The liquid portion is taken and further boiled till it forms a dense mixture. 'Ghee' (clarified butter) is added to the mixture and the mixture boiled again. The decoction is then topically applied to affected areas.
25	<i>Codiaeum variegatum</i> (L.) Blume	Euphorbiaceae	Pata bahar	Leaf	Conjunctivitis. Leaf juice is applied to the eyes.
26	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Amloki	Fruit	Headache. Crushed fruits of <i>Phyllanthus emblica</i> are combined with powdered wood of <i>Santalum album</i> and rose water (water obtained from soaking <i>Rosa damascena</i> flower petals in water) and applied topically to the scalp. Conjunctivitis. Juice obtained from crushed unripe fruit is applied externally to the eyes.
27	<i>Acacia moniliformis</i> Griseb.	Fabaceae	Akashi	Bark	See <i>Echinochloa stagnina</i> .
28	<i>Butea monosperma</i> Lam.	Fabaceae	Polash	Gum	Skin infections. Gum is applied topically to affected areas.
29	<i>Cassia fistula</i> L.	Fabaceae	Banor lathi	Fruit	Tonsillitis, rheumatism, leprosy. Fruits are boiled and paste prepared. The paste is applied topically over the tonsil or other affected area for 2-3 days.
30	<i>Clitoria ternatea</i> L.	Fabaceae	Aparajita (white- and blue-flowered variety)	Whole plant	Filariasis. Juice obtained from crushed whole plant (white-flowered variety) is orally taken. Dysentery. Juice obtained from crushed flowers of the blue-colored variety is taken orally. Urinary problems, rheumatism. Juice obtained from crushed flowers of the blue-colored variety is orally taken.

					Antidote to snake venom, to ease delivery pain. Root juice of the white-colored variety is orally taken.
31	<i>Glycyrrhiza glabra</i> L.	Fabaceae	Josthimodhu	Root	See <i>Terminalia chebula</i> .
32	<i>Mimosa pudica</i> L.	Fabaceae	Lojjaboti	Whole plant with flowers	Piles. Juice obtained from crushed whole flowering plant is orally taken with sugar for 3 months.
33	<i>Saraca asoca</i> (Roxb.) Willd.	Fabaceae	Ashok	Bark	Anemia. Juice obtained from crushed bark is orally taken twice daily with milk and sugar.
34	<i>Cinnamomum tamala</i> T. Nees & Eberm	Lauraceae	Tejpata	Leaf	See <i>Alocasia indica</i> . See <i>Echinochloa stagnina</i> .
35	<i>Cinnamomum verum</i> Presl.	Lauraceae	Daruchini	Bark	See <i>Alocasia indica</i> . See <i>Echinochloa stagnina</i> . See <i>Andrographis paniculata</i> .
36	<i>Allium sativum</i> L.	Liliaceae	Roshun	Clove	See <i>Calotropis procera</i> .
37	<i>Aloe vera</i> (L.) Burm. f.	Liliaceae	Ghrito kumara	Leaf	Piles, stool clarification. Juice obtained from soft pulp within the leaves is orally taken with 'ghee' (clarified butter) twice daily. Irregular menstruation. Soft pulp within the leaves is taken orally on a regular basis. See <i>Terminalia chebula</i> .
38	<i>Punica granatum</i> L.	Lythraceae	Dalim	Bark	See <i>Echinochloa stagnina</i> .
39	<i>Gossypium arboreum</i> L.	Malvaceae	Karpas	Leaf, unripe fruit	Burning sensations during urination. Leaves are boiled in milk followed by cooling the decoction. The decoction is taken orally once in the morning. Pus within the ears. Unripe fruit juice is applied internally to the ears twice daily in the morning and evening.
40	<i>Hibiscus rosa sinensis</i> L.	Malvaceae	Joba	Flower bud, leaf, flower	Tongue lesions. Leaf juice is applied to tongue. Excessive menstruation. Flowers are fried in 'ghee' (clarified butter) and taken orally. Conjunctivitis. Paste of flowers is topically applied above and below the eyes. See <i>Echinochloa stagnina</i> .
41	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Neem	Leaf, bark	Swelling of veins. Paste is first prepared from crushed leaves. Pills made from the paste are dried and swallowed with water. The medication is continued for 15 consecutive days. Scabies. Leaves of <i>Azadirachta indica</i> are crushed with rhizomes of <i>Curcuma longa</i> and topically applied. Helminthiasis. Dried and powdered leaves are taken with cold water in the morning on an empty stomach. Wet dream. 25 drops of juice obtained from crushed bark of <i>Azadirachta indica</i> is taken with milk and juice obtained from crushed rhizomes of <i>Zingiber officinale</i> .
42	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	Kanthal	Bark	See <i>Echinochloa stagnina</i> .
43	<i>Moringa oleifera</i> Lam.	Moringaceae	Sojina	Root, leaf	Ear ache. Root juice is applied internally to the ears. Bloating in children. Leaf juice is orally taken with salt.
44	<i>Psidium guajava</i> L.	Myrtaceae	Peyara	Leaf	See <i>Echinochloa stagnina</i> .
45	<i>Syzygium aromaticum</i> (L.) Merr. & L.M. Perry	Myrtaceae	Lobongo, Long	Flower bud	See <i>Alocasia indica</i> . See <i>Adhatoda vasica</i> . See <i>Echinochloa stagnina</i> . See <i>Andrographis paniculata</i> .
46	<i>Nyctanthes arbor-tristis</i> L.	Oleaceae	Sheuli	Flower, leaf	Hair loss. Juice obtained from crushed flowers is topically applied to scalp. Helminthiasis. Leaf juice is taken orally with sugar.

47	<i>Oxalis corniculata</i> L.	Oxalidaceae	Amrul	Leaf	Dysentery. Leaves are boiled in milk (which has already been made dense through boiling). The milk is taken orally thrice daily.
48	<i>Piper betle</i> L.	Piperaceae	Paan	Leaf	Respiratory difficulties in children. Oil is put on the upper surface of the leaf. The leaves are then warmed and applied as poultice over the chest.
49	<i>Piper nigrum</i> L.	Piperaceae	Gol morich	Fruit	See <i>Adhatoda vasica</i> . See <i>Andrographis paniculata</i> .
50	<i>Piper peepuloides</i> Roxb.	Piperaceae	Pipul	Fruit	See <i>Adhatoda vasica</i> .
51	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Shada durba	Leaf	Lesions on tongue (symptoms: seems like infections or pustules all over the tongue). Crushed leaves are mixed with ½ chatak (local measure, 16 chataks approximate 1 kg) 'ghee' (clarified butter) and taken orally for around 15 days till cure and regain of appetite.
52	<i>Echinochloa stagnina</i> (Retz.) P. Beauv.	Poaceae	Parwa	Bark	Puerperal fever. The healer diagnosed two types of puerperal fever (symptoms: wasting away of body, stomach pain, paleness of face, loss of appetite): dry and wet puerperal fever. The healer mentioned that 108 plant parts are necessary, but the following plant parts are enough for treatment. Bark of <i>Echinochloa stagnina</i> is combined with bark of <i>Artocarpus heterophyllus</i> , bark of <i>Dillenia indica</i> , bark of <i>Sterculia villosa</i> , root of <i>Bombax ceiba</i> , root of <i>Aristolochia indica</i> , bark of <i>Mangifera indica</i> , bark of <i>Cinnamomum tamala</i> , bark of <i>Terminalia arjuna</i> , bark of <i>Acacia moniliformis</i> , 7 flower buds of <i>Hibiscus rosa sinensis</i> , leaves of <i>Psidium guajava</i> , 7 pieces of bark of <i>Cinnamomum verum</i> , 7 fruits of <i>Elettaria cardamomum</i> , 7 floral buds of <i>Syzygium aromaticum</i> , rhizome of <i>Curcuma longa</i> , bark of <i>Punica granatum</i> , and rhizome of <i>Zingiber officinale</i> . The mixture is boiled in 1 ser (local measure approximates 1 kg) till the weight is reduced to ½ ser. The decoction is taken twice daily, once in the morning on an empty stomach and once in the evening after meals. This is continued for 15 days, although according to the healer the sickness is cured within 3-5 days. During this period of medication, consumption of <i>Tenulosa ilisha</i> (Hilsa fish, Bengali: Ilish), male goat meat, duck meat, and shrimp is not advised.
53	<i>Saccharum spontaneum</i> L.	Poaceae	Khagor	Leaf	'Meho' (diabetes). Leaf juice is orally taken.
54	<i>Rosa damascena</i> Mill.	Rosaceae	Golap	Flower petal	See <i>Phyllanthus emblica</i> .
55	<i>Aegle marmelos</i> (L.) Corr.	Rutaceae	Bel	Fruit, root, bark	Chronic dysentery. Pulp within the fruit is dried, fried and powdered and taken orally with curd. Burning sensations in the body. Dried inner pulp of the fruit is soaked in water overnight followed by drinking the mixture on an empty stomach the following morning. Heart palpitations. Juice obtained from crushed roots and bark is orally taken.
56	<i>Citrus macroptera</i> Montr.	Rutaceae	Bonya jamor, Bonya lebu	Leaf	Helminthiasis. For children, a paste of leaves is applied to the navel. For adults, pills prepared from leaf paste are taken orally.
57	<i>Santalum album</i> L.	Santalaceae	Shada chandan	Wood	See <i>Phyllanthus emblica</i> .
58	<i>Celsia coromandeliana</i> Vahl	Scrophulariaceae	Kukur mutra	Root	Pain in the forehead. Roots are put inside a cloth and the cloth is applied like a bandage around the forehead.
59	<i>Datura metel</i> L.	Solanaceae	Dhutura	Leaf	See <i>Calotropis procera</i> .

60	<i>Solanum surattense</i> Burm. f.	Solanaceae	Kontikari	Fruit	See <i>Adhatoda vasica</i> .
61	<i>Abroma augusta</i> L.	Sterculiaceae	Olot kombol	Stem	Weakness. Stems are soaked in water to get the stem juice out in the water. The water along with stem juice is taken regularly orally with sugar or 'mishri' (crystalline sugar).
62	<i>Sterculia villosa</i> Roxb.	Sterculiaceae	Udal	Bark	See <i>Echinochloa stagnina</i> .
63	<i>Vitex negundo</i> L.	Verbenaceae	Nishi	Leaf	Lesions on the tongue. The opposite sides of the leaves are brushed on the tongue till blood comes out. Following this procedure once, the lesions will dry out.
64	<i>Elettaria cardamomum</i> (L.) Maton	Zingiberaceae	Elach	Fruit	See <i>Alocasia indica</i> . See <i>Echinochloa stagnina</i> . See <i>Andrographis paniculata</i> .
65	<i>Curcuma longa</i> L.	Zingiberaceae	Holud	Rhizome	See <i>Echinochloa stagnina</i> . See <i>Azadirachta indica</i> .
66	<i>Zingiber officinale</i> Rosc.	Zingiberaceae	Ada	Rhizome	See <i>Echinochloa stagnina</i> . See <i>Azadirachta indica</i> .

From the number of plants used, it appeared that gastrointestinal disorders, pain, respiratory disorders, and skin disorders were the major ailments suffered by the clan population. Gastrointestinal disorders were treated with 9 plant species, pain with 8 plant species, skin disorders with 6 plant species, and respiratory disorders with 5 plant species. This result was not surprising. As mentioned before, the Rai clan (adults and children) worked mostly in the adjoining tea gardens as agricultural laborers, i.e. either preparing the soil or plucking tea leaves from morning till evening. The pay was meager, and the clan lived under unhygienic conditions with poor quality of drinking water. These conditions were compatible with occurrence of gastrointestinal, skin, and respiratory disorders. Also the back-breaking labor would induce pain in the body or body parts. The clan members were basically illiterate, which in turn made them averse to accepting modern amenities even if they could afford it.

The formulations of the healer were both simple as well as complex. To cite a few instances of simple formulations, constipation was treated by oral administration of juice obtained from leaves of *Andrographis paniculata* along with honey. Headache was treated with juice obtained from leaves of *Centella asiatica*, which was orally administered with milk. It is to be noted that the leaf juice of *Andrographis paniculata* is very bitter (in fact, the plant is known as King of bitters), and so honey would make the juice more palatable. The leaf juice of *Centella asiatica* is not bitter in taste; milk was administered with leaf juice. It is widely believed in Bangladesh that warm milk can provide relief from constipation. However, studies have shown that milk may cause constipation in some children [10]. A number of formulations were complex. As an example, for treatment of dry coughs, 10 leaves of *Adhatoda vasica* were combined with 10 fruits of *Piper nigrum*, 10 flower buds of *Eugenia caryophyllus*, 10 fruits of *Piper peepuloides*, and 1 tola (local measure, 80 tolas

approximate 1 kg) of *Solanum surattense* fruits. The mixture was crushed together and boiled in ½ kg water till total weight was about 200g. The decoction was then strained and the liquid part taken orally thrice daily till cure.

The healer made a number of uses of four spices in his formulations, namely bark of *Cinnamomum verum*, leaves of *Cinnamomum tamala*, floral buds of *Syzygium aromaticum*, and fruits of *Elettaria cardamomum*. This combination, in full or in part, along with other plant parts, was used to treat stomach pain, rheumatic pain, and puerperal fever. These spices are generally believed in Bangladesh to ease digestion, and so may have been added by the healer to alleviate gastrointestinal upsets caused by other plants or plant parts in the formulations. However, anti-inflammatory, analgesic and antipyretic activities of methanolic extract of *Cinnamomum tamala* leaves have been described in experimental animal models [64]. The analgesic effect of *Syzygium aromaticum* essential oil has also been reported in mice [23]. The essential oil of *Elettaria cardamomum* has also been shown to have analgesic properties [2]. Thus the spices in combination could have a synergistic analgesic and antipyretic effect besides alleviating possible gastrointestinal disturbances.

The antitussive effect of *Adhatoda vasica* has been reported [13], a plant used by the healer against dry coughs. Other plant parts used by the healer in his anti-dry cough formulation included *Piper nigrum*, *Piper peepuloides*, *Syzygium aromaticum*, and *Solanum surattense*. Piperine, a constituent of *Piper nigrum*, is widely used in Ayurvedic herbal preparations for treating coughs because of its bronchodilatory effects [60]. Notably, piperine is also present in other *Piper* genera plants, and possibly *Piper peepuloides*. *Syzygium aromaticum* is also used in Indian traditional medicine for treatment of coughs [4]. The efficacy of *Solanum surattense* in polyherbal formulations against coughs has also been demonstrated [16]. The choice of plants by the healer

again strongly indicates that the healer possessed quite extensive knowledge about the medicinal properties of plants and plant parts and used various plant parts in combination to produce a synergistic beneficial effect.

The Rai healer used the plant, *Centella asiatica*, for treatment of headache. Both central and peripheral analgesic effects have been shown with aqueous extract of the plant [63]. The analgesic property of *Alocasia indica* has been described [37]; notably, the plant was used by the healer to treat rheumatic pain. Bark of *Calotropis procera* along with leaves of *Datura metel* and cloves of *Allium sativum* were used by the healer in combination to treat pain over the whole body. The analgesic effect of latex of *Calotropis procera* has been shown [11]. Analgesic properties of *Datura metel* aqueous seed extract has also been reported [66]. Furthermore, the analgesic and antinociceptive activities of *Allium sativum* clove has also been demonstrated in experimental animal models [27]. Since all the three plants have pain alleviating properties, the plants used in combination can produce a strong synergistic effect for relief from pain. Moreover, *Datura metel* contains tropane alkaloids, which can produce a sedative effect [36], and so calm down a person suffering from whole body pain.

*Terminalia arjuna*, used by the healer to treat pain in the bones has reported analgesic effects [34]. The use of mustard oil (oil obtained from seeds of *Brassica juncea*) along with the crushed leaves and bark of *Terminalia arjuna* can serve several purposes. The oil can act as an emollient; it can help spread evenly the crushed mixture over painful areas; and it can help absorption of lipid soluble pain killing chemicals from the skin. The oil itself can be helpful in alleviating pain. Notably, leaves of *Brassica juncea* has been shown to demonstrate antinociceptive activity in acetic acid-induced gastric pain model in mice [49]. Crushed fruits of *Phyllanthus emblica* were combined with powdered wood of *Santalum album* and rose water (water obtained from soaking *Rosa damascena* flower petals in water) and applied topically to the scalp by the healer for treatment of headache. Aqueous extract of fruit of *Phyllanthus emblica* reportedly possess analgesic activity [26]. Methanolic extract of wood of *Santalum album* also reportedly have analgesic activity and is traditionally used in India for cure of headache [56]. It is also interesting to note that hydroalcoholic extract of *Rosa damascena* flower petals and its essential oil also has been reported to possess analgesic activity [17]. Thus, once again it is evident from the available scientific evidences that the healer has combined his different plant parts with care, so that the combination can provide a strong synergistic effect against pain.

Possible thrust areas for further scientific research include scientific studies on *Coccinia indica* and *Saccharum spontaneum*, both plants being used

by the healer to treat diabetes, against which modern medicine has no total cure. A number of reports exist on the antidiabetic effects of *Coccinia indica*. Administration of *Coccinia indica* leaf extract to normal and streptozotocin diabetic animals has been shown to exhibit significant hypoglycemic and antihyperglycemic effect and reverse biochemical complications in experimental diabetes [65]. Treatment of diabetes with the plant has also been described before [28]. The Khampti tribal people living in Lohit district of the Eastern Arunachal Himalaya, India, use *Saccharum spontaneum* for treatment of diabetes. Thus these two plants can be researched with more attention for their possibilities in the mitigation of diabetes and discovery of novel antidiabetic drugs.

*Cassia fistula* and *Clitoria ternatea* were two plants used by the healer to treat rheumatism, another disease against which allopathic medicine has no total cure. The Bhoja tribe of Dehradun district in Uttarakhand, India, use *Cassia fistula* to treat rheumatism [61]. *Clitoria ternatea* reportedly possess anti-inflammatory and analgesic properties and so can be useful in alleviating rheumatic pain and inflammation [62]. The plant deserves further attention towards possible relief from rheumatism.

Taken together, although not all plants have been reviewed as to the scientific evidences validating their traditional uses by the Rai tribal healer, enough has been discussed to demonstrate that the medicinal plants of the healer merit further scientific studies. Such studies can lead to discovery of lead compounds and possibly novel drugs, which can benefit the people. Also since allopathic medicine is often costly and not available in rural areas, scientific validation of tribal medicinal plants can enable the healers to use the plants with much more confidence, once such scientific results have been communicated and explained to them.

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